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ABSTRACT

This study was designed to identify: (1) status of science teaching and science teachers' and principals' attitudes toward change in science curricula and school practices during the 1979/80 school year in 100 public secondary schools (grades 7-12) that participated in a previous study in 1970/71, and (2) changes that have occurred in science curricula and school practices in the selected schools from 1970/71 to 1979/80. The target population of 1979/80 consisted of public secondary schools (grades 7-12) which participated in 1970/71 and in which both the principal and the teacher(s) responded. Ten states were selected for the study because they met specific criteria. From each of the ten sampled states, ten secondary schools were selected randomly. Thus, the total number of the sampled schools was 100. Principals of each of the sampled schools were requested to participate in the study; three science teachers were randomly selected from each building. Results of the status study are described in the report. These data were also compared to the 1970-71 study. Recommendations for future research and policy are included. (Author)

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SECONDARY SCHOOL SCIENCE CURRICULA PRACTICES: A TEN-YEAR LONGITUDINAL STUDY OF SCHOOLS IN TEN STATES

DISSERTATION

Presented in Partial Fulfillment of the Requirements for
the Degree Doctor of Philosophy in the Graduate
School of The Ohio State University

By

Hussein Bashir Mahmoud, B.S., B.A., M.A.

* * * * *

The Ohio State University

1981

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SECONDARY SCHOOL SCIENCE CURRICULA PRACTICES: A TEN-YEAR LONGITUDINAL STUDY OF SCHOOLS IN TEN STATES

By

Hussein Bashir Mahmoud, Ph.D.
The Ohio State University, 1981
Professor Robert W. Howe, Adviser

This study was designed to identify: (1) status of (a) science teaching and science teachers' and principals' attitudes toward change in science curricula and school practices during the 1979/80 school year in 100 public secondary schools (grades 7-12) that participated in a previous study in 1970/71 and (2) changes that have occurred in science curricula and school practices in the selected schools from 1970/71 to 1979/80.

The target population of 1979/80 consisted of public secondary schools (grades 7-12) which participated in 1970/71 and in which both the principal and the teacher(s) responded. Ten states were selected in the study because they met specific criteria. From each of the ten sampled states, ten secondary schools were selected randomly. Thus, the total number of the sampled schools was 100 schools. Principals of each of the sampled schools were requested to participate in the study; three science teachers were randomly selected from each building.

Instruments used were: (1) status of science teaching in public secondary schools in the 1979/80 school year (principals' questionnaire); (2) attitudes toward change in science education (principals' questionnaire and teachers' questionnaire); and (3) checklist for

assessment of science teachers (principal's perception and teacher's perception).

Descriptive statistics, correlation coefficients, t-tests, chi-square, scattergram plots and analysis of variance were used to analyze the data.

Results of the status study are described in the report. These data were also compared to the 1970-71 study and to several recent national studies. Similarities and differences between this study and the other studies are indicated. Most data are consistent with previous studies or extrapolated data from previous studies. Substantial decrease in total enrollment occurred between 1971 and 1979; only slight decrease occurred in the percentage of students enrolled in science between 1971 and 1980. A greater variety of courses were offered in 1980 and second year or advanced placement classes were more common. While laboratory instruction was used by many teachers, the emphasis on laboratory instruction decreased between 1971 and 1980. Other findings are reported.

Recommendations for future research and policy are included.

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CHAPTER I

INTRODUCTION

Since the mid-1950's interest and concern have focused on science education at the public school level. The National Science Foundation, (NSF), charged with improving instruction in science and mathematics, has played a special role in the development of "new, innovative" science curriculum project materials. Federal funds via the National Defense Act of 1958 and the Elementary and Secondary Education Act of 1965 have been available for public schools to stimulate the use of innovative science curriculum projects.

Maben (1971), Howe (1974), Welch (1974), Berman et al. (1975), Helgeson et al. (1977), Hurd (1978) and Evans (1979) indicate that millions of dollars and enormous amounts of effort have been directed toward upgrading and updating science education over the past two decades. Hurd and Paldy (1974) state that the NSF curriculum improvement programs have had major influences on the theory and practice of curriculum development, and have had a substantial impact upon various parts of institutional structures. Skinner (1968) notes that the materials which have been made available for teaching science in high school are genuinely exciting but classroom practices are slow to change.

Recognizing the need for identifying science teaching conditions in public schools, the Faculty of Science and Mathematics Education at The Ohio State University, in cooperation with the Science, Mathematics and Environmental Education ERIC Clearinghouse at The Ohio State University (OSU), conducted two national survey studies of science teaching in public schools in 1970-71. The two survey studies were designed to collect data from a sample of public schools in all states and the District of Columbia. The study of elementary schools (Howe et al., 1974; and Steiner et al., 1974) provide a description of science teaching practices and selected science teacher characteristics during the 1970-71 school year.

The study of secondary schools (Schlessinger et al., 1973; and White et al., 1974) gathered information relative to the use of NSF materials, course offerings, teaching practices, school organization, staffing and conditions during the 1970-71 school year.

The Need for the Study

Longitudinal Study for Change in Science Curricula and School Practices.

Studying the change in the conditions of science education is needed. Sikorski et al. (1976) state that meaningful changes take time and considerable effort. Gross et al. (1971), Berman and McLaughlin (1975), Mann (1976), Greenwood et al. (1975) have studied innovation efforts longitudinally or retrospectively. Two major reasons are stated for studying change outcomes over time: (1) what appears to be a success may later turn into a failure and vice versa; and (2) detailed studies of the change process over time will increase our knowledge of the way strategies operate. Knowledge of the implementation process may well be more important than knowledge of outcomes (Fullan and Pomfret, 1975; Kester, 1976). Thus,a follow-up study for science education conditions from 1970-71 to 1979-80 is important in order to identify: (1) current status of science teaching in a number of selected secondary schools that participated in the OSU study of 1970-71; and (2) changes in science curricula and school practices and why changes have or have not occurred.

Science Teachers' and Principals' Attitudes toward Change

The Rand study (Berman et al., 1977) found that the institutional characteristics of the local school district affect the local process of change. Two institutional factors were found to influence project change in the classroom: the quality of management leadership and support, and the characteristics of teachers.

The findings of other studies (Sikorski et al., 1976; Parkay, 1976) indicate that the most crucial roles in changes are played by principals and teachers. The school principal's leadership style, support, and own change-orientation importantly influence the course of change (Anderson and Horn, 1972; Daveney, 1974; Berman and McLaughlin, 1975; Chesler et al., 1975; Schmuck et al., 1975). Innovation is enhanced in schools where the principal's attitude toward change and those who want to change is supportive and encouraging (Greenwood et al., 1975; Mann, 1976; Turnbull et al., 1974).

Teacher resistance can be fatal to change and teacher support of an innovation is an important facilitator (Nygren, 1976, Yegge et al., 1971). The studies of Darrow (1972), and Hoy and Blankenship

(1972) reveal the association between the beliefs of science teachers and acceptance of a new science curriculum. Thus, the identification of teachers' and principals' attitudes toward change in science programs and practices is needed to determine why changes have occurred and to determine the extent of their support for program changes.

Educational State Policy (Legislation and Regulations)

The role of the states in shaping school policy has accelerated in the last 20 years (Milstein, 1976; Fuller and Person, 1969). Helgeson, et al. (1977) reported that the influence of the state governments on science education has increased since 1955. Materials reviewed from various states indicate a definite impact of state action on science programs. This influence on science is due to state policies and regulations that are related directly or indirectly to science teaching. State governments differ markedly in the type and extent of influence they exert on science education.

Wirt (1977) explored the extent of differences among the 50 states in the degree of centralization of control over local school policy by the state government. Wirt used the content analysis of the laws of the 50 states in 36 areas of educational policy. The analysis was performed during 1972-73 by the Lawyer's Committee for Civil Rights. Content analyses were made of the statements of legal authority over schools in the policy areas covering each state's constitution, status, court decisions and administration regulations (See Table A.1, Appendix A). A total state score (SCS) ranging from 0.00 to 6.00 was given for each policy area for each state. The results show that there is considerable variation among the states ranging from an SCS of 1.86 for Wyoming to an SCS of 6.00 for Hawaii (see Table A.2, Appendix A).

There appear to be three patterns of states regarding centralization patterns: (1) those with substantial centralization; (2) those with substantial decentralization; and (3) those that are intermediate. Thus, the investigation of the conditions of science education in a variety of states of different centralization patterns is needed to determine how state legislation and policies are related to changes in science programs and practices.

In summary, a number of changes have occurred in secondary school science education since 1970/71. This study will help to identify specific changes in about 100 schools, variables that relate to these changes, and changes planned for the future. The study also provides information that can be used for future longitudinal research.

Purpose of the Study

This study is designed to:

1. Identify the current status of science teaching during the 1979-80 school year in a sample of public schools (grades 7-12) that participated in the OSU study of 1970-71.
2. Identify science teachers' and principals' attitudes toward change in science curricula and school practices.
3. Identify changes that have occurred in science curricula and school practices in the selected schools from 1970-71 to 1979-80.
4. Identify realtionships between change in science curricula and school practices, and state control of education.
5. Continue establishing a longitudinal data baseline for future research.

Definition of Terms

Advanced Science Course

An enriched and accelerated course or program of studies in any area of science, which is specially designed for students with superior achievement, aptitude, or interest in science. It is often a second course in the particular field of science (Buckeridge, 1973).

Attitude

An organization of several beliefs focused on a specific object or situation predisposing a person to respond in some preferential manner (Rokeach, 1960).

Equipment

This refers to non-perishable, non-consumable items, such as aquaria, microscopes, models, balances and charts (Baker, 1973).

Perception

The way one comes to know the world or the way one experiences the world of objects and events (Weintraub and Walker, 1966).

Public Secondary School

Any educational institution operated on public funds under the principal or head teacher, including any combination of grade levels from seven through twelve, except any lower grade under an elementary organization (Schlessinger, et al., 1971).

School Type

The type of school organization, in particular to the grade levels that are included in a public secondary school. For example, all public secondary schools having only grades 9-12 inclusive will be considered to be one school type (Chin, 1971).

Science Course Improvement Project

A course or program of studies in any area of science developed by a group of individuals, under the sponsorship of the National Science Foundation, universitites, school systems, state departments of education, or educational organizations, to improve instruction in that area of science (Baker, 1973).

Science Course or Subject

Any course of study designated as "science" by the individual school or school system (Chin, 1971).

Science School Practices

The extent of the use of science curricula materials, textbooks, courses, learning activities, facilities, equipment and science budget.

Secondary School Science Teacher

A teacher who teaches at least one science subject or course in any grade level or combination of grade levels from 7 through 12 in any school designated as a public secondary school (Schlessinger et al., 1971).

Supplies

This refers to perishable or consumable items that must continually be replenished, such as chemicals, living specimens, and glassware (Baker, 1973).

Design of the Study

Sources of Data for the study

The data for this study were obtained from the principal and three science teachers from each school of the sample schools.

Instruments

The instruments to be used for the collection of data are listed below. The abbreviations used to refer to the various instruments and the approximate times for completing each instrument are given in parentheses.

Principal Data

1. Status of Science Teaching in Public Secondary Schools in 1979-80 school year: (Q:SP). Principal Questionnaire (25-45 minutes).
2. Attitudes toward Change in Science Education: (Q:AP). Principal Questionnaire (20 minutes).
3. Checklist for Assessment of Science Teacher (CAST:PP). Principal's Perception (15-25 minutes).

Teacher Data

1. Status of Science Teaching in Public Secondary Schools in 1979-80 school year: (Q:ST). Science Teacher Questionnaire (25-45 minutes).
2. Attitudes toward Change in Science Education: (Q:AT). Science Teacher Questionnaire (20 minutes).
3. Checklist for Assessment of Science Teacher (CAST:TP). Teacher's Perception (15-25 minutes).

Population and Sample

Population

The population of the original 1970-71 OSU study consisted of all public secondary schools in the U.S. A stratified random sample, stratified by student enrollment and by state, was selected from this population. The target population of 1979-80 consisted of public secondary schools (grades 7-12) which participated in the 1970-71 OSU study and in which both the principal and the teacher(s) responded.

Sample

Ten states were selected from all over the country because they met specific criteria (see Chapter III). From each of the ten sampled states ten secondary schools (Grades 7-12) were selected randomly. Thus, the total number of the sampled schools was 100 schools. Principals of each of the sampled schools were requested to participate in the study. Three science teachers were randomly selected from each building.

Assumptions

The assumptions associated with this study were:

1. There was a need to obtain accurate, reliable and relevant information related to: (a) the status of science teaching during the 1979-80 school year in a sample of public schools (grades 7-12) that participated in the OSU study of 1970-71; and (b) the changes that have occurred in science curricula and school practices in the selected schools from 1970-71 to 1979-80.
2. The use of both the teacher and principal questionnaire of the status of science teaching provided the needed data regarding the conditions of science education in the selected schools.
3. The instruments used to gather data were valid and reliable measures regardless of the location of the schools.
4. Comparisons could be made between the data of the OSU study of 1970-71 and the data of this study of 1979-80.

5. The principals' and the teachers' responses on the attitude questionnaire reflected their views and attitudes toward changes in science curricula and school practices.
6. The paper and pencil instruments measured the different constructs that they claimed to measure.
7. A score on the CAST reflected teachers' and principals' perceptions on science classroom practices.
8. A School Centralization Score (SCS) measured the extent of state control of education.

Delimitations of the Study

The items below were considered to be delimitations of the study:

1. The measure of control of education was based on Wirt's School Centralization Score (SCS) scale.
2. The schools were selected from ten states of the U.S. that rank high, low and average in the state control of education.
3. The selection of schools was delimited to public secondary schools (7-12) from which a principal and a teacher participated in the 1970-71 OSU study.
4. Secondary schools sampled for this study were delimited to three types of schools (grades 7-9, grades 10-12, and grades 9-12) and to schools with enrollments of more than 300 students.
5. The measure of attitude toward change in science curricula and school practices was obtained by the questionnaire developed for this study.

6. The current status of science teaching in the selected schools was measured by the two questionnaires (principal and teacher) developed for this study.

Limitations

The following statements represent limitations to the study:

1. Institutional and subject participation in the study was voluntary.
2. The results of this study should be generalized only to the extent that the sample resembles other populations.
3. The study was limited to the extent to which the developed questionnaires were valid and reliable measuring devices for obtaining information about science curricula.
4. The public secondary schools were limited to those listed on the tapes of the OSU 1970-71 study.
5. The data that were collected in this study were intended to serve as a longitudinal baseline for future research and were not intended for the evaluation of existing science education conditions.

Overview

This dissertation has five chapters:

Chapter I presents the general problem area and the background and importance of this study. Chapter II reviews the related literature from which the variables investigated and the hypothesis for this study emerged. Chapter III describes the procedures used to: (1) select schools, principals and science teachers; (2) develop the instruments; and (3) collect and analyze the data. Chapter IV presents the results of the analysis of the data. Chapter V contains a summary of results, the conclusions and the recommendations resulting from this study.

CHAPTER II

REVIEW OF RELATED LITERATURE

This chapter presents a review of the literature related to the following major areas:

1. Review of research related to the status of science teaching practices and curricula of public secondary schools (Grades 7-12). Major attention is given to science practices and the changes in science practices over the last decade (from 1970/71 to 1979/80 school years).
2. Review of research related to the change process and factors influencing educational change.

Review of Science Status and Change in Science Practices Literature

Extensive research has been done to identify the status of science teaching practices and the changes that have occurred in science curricula and school practices of public secondary schools (Grades 7-12). The purpose of this section is to: (1) identify several reviews of the status of science curricula and the changes in science practices; and (2) present major research and surveys that appear to be relevant to this study.

Studies Related to the Status of Science Curricula and School Practices from 1950 to 1970

A number of studies were conducted prior to 1970. Those used to identify trends are listed below. Bibliographic citations are included in the bibliography. Among the studies identified as relevant were in the following:

Johnson (1950), Martin (1952), The National Association of State Directories of Teacher Education and Certification and the American Association for the Advancement of Science (NASDTEC-AAAS, 1963), Brown and Obourn (1963), Rogers (1967), Bila and Bligh (1968), The National Science Teachers Association (1965), Hershkowitz (1971), Maberly (1967), Maberly and Margolin (1965), Young (1965), Thompson (1969) and Fornoff (1969).

Several commonalities or findings which reinforced each other were formed from these national studies reviewed.

In the surveys reported, that were conducted after the 1950's, findings showed:

(1) Conventional science course offerings were basically the same and included general science, biology, chemistry, physics, and earth science (Johnson, 1950; NASDTEC-AAAS, 1963; Bila and Bligh, 1968).

(2) Biology was most often taught as a tenth grade subject, and chemistry was primarily an eleventh grade course (Maberly, 1967; Bila and Bligh, 1968).

In the surveys reported, that were conducted during the 1960's, findings showed:

(1) Greater usage of various Science Course Improvement Projects (Maberly and Margolin, 1965; Maberly, 1967; Thompson, 1969; Fornoff, 1969).

(2) The majority of secondary schools and class periods within the range of 40-59 minutes, and period scheduling was most common (Johnson, 1950; Maberly and Margolin, 1965; Maberly, 1967; Bila and Bligh, 1968; Fornoff, 1969).

(3) The percentage of male teachers in secondary science teaching had not changed to any great extent since the 1950's. Male teachers represented approximately 66 percent of the secondary school science teachers (Johnson, 1950; Hershkowitz, 1971).

Studies Related to the Status of Science Curricular and School Practices from 1970 to 1980

Selected national surveys conducted between 1970 and 1980 are described. Studies related to a single or a few states are not included.

I. A Survey of Science Teaching in Public Schools of the United States (The Ohio State University, 1971)

A national survey of science teaching was conducted in 1970-71 school year by the Center for Science and Mathematics Education at The Ohio State University in cooperation with ERIC/SMEAC. This study (Schlessinger et al., 1973; White et al., 1974) was designed to provide a description of science teaching practices in the 50 states and the District of Columbia. Over 6,000 secondary schools from all over the USA were involved in this survey. A sample of responding schools of approximately 2,500 with a student enrollment of over 3,100,000 was selected for analysis (Howe, 1974).

This study was developed from three concurrent regional surveys, each of which focused on one of three geographical areas. The three regional surveys were conducted as doctoral studies by Chin (1971), Buckeridge (1973) and Baker (1973).

Data from a sample of public secondary schools in the Far West and Great Lakes regions were examined and analyzed by Chin. Buckeridge's study was of the geographic area represented as the New England, the Mideast and the Southwest regions. The Southeast, Rocky Mountains and Plains regions were included in Baker's study.

Procedures

The procedures of the 1970/71 OSU study are described briefly.

Sample design

The population consisted of all public secondary schools in the United States that were listed in the state education directories for the 1969-70 school year. The number of secondary schools sampled was 6,398 or approximately 25 percent of the schools listed in the state directories.

The sampling design within each state involved three stages: (1) stratified random selection of secondary schools; (2) random selection of secondary science teachers within the selected schools; and (3) random selection of science classes for the selected teachers.

Development of questionnaires

Two questionnaires, a principal's and a science teacher's questionaire, were developed to procure the data needed to describe the practices.

The principal's questionnaire was designed to provide summative data for all the science teachers, science classes, and science programs in the school. The questionnaire had twenty-six items grouped into seven sections. The sections included: (1)

screening questions; (2) school organization and scheduling; (3) grouping of science classes; (4) teaching staff; (5) science budget; (6) course offerings; and (7) miscellaneous. In all there were 141 variables in the principal's questionnaire.

The science teacher's questionnaire was designed to obtain data on the characteristics of public secondary school science teachers and specific practices and conditions related to science instruction. The instrument contained twenty-one items grouped into six sections. The sections included: (1) school organization; (2) teacher characteristics; (3) teaching load; (4) special facilities and audio-visual aids; (5) science teaching; and (6) miscellaneous. A total of 135 variables were included in this instrument.

Responses to questionnaires

Responses were received from about 70 percent of the total sample. Questionnaires from approximately 2,500 principals and from 2,500 teachers were selected for use in the analyses. No significant differences were found between the responding sample and the schools selected for longitudinal research.

Findings

Findings reported by Schlessinger et al., 1973; White et al., 1974 and Howe, 1974 are summarized in the following sections.

School organization

Of the secondary schools analyzed 36.4 percent were four-year high schools. Three-year high schools made up 24.1 percent of the sample, while junior high schools were 18.1 percent of the schools.

Six-year secondary schools were found in 10.4 percent of the cases. All other types made up the remaining 10.1 percent.

Financial support of science instruction

While most schools, primarily the larger ones, had budgets for purchasing science equipment and materials, many did not. Many remarked they did not have sufficient funds for purchase of supplies. Most budgets reported were from one to three dollars per student per year.

Enrollments in science courses

While enrollments in general science were decreasing, a very large number of students were still taking such courses, particularly students in Grades 7, 8, 9 and 10. Two common course patterns were evident for junior high schools that had discontinued general science. These were life science, Grade 7; physical science, Grade 8; and earth science, Grade 9; and physical science, Grade 7; earth science, Grade 8; and life science or biology, Grade 9.

The most common courses in Grades 10, 11 and 12 were biology, chemistry, physical science and physics. Biology was the most common course completed by students and appeared to be the last science course completed by more than half the students. While the number of students who were taking chemistry was quite sizeable, the number who enrolled in physics appeared to be quite small. Several schools indicated they offered physical science as an alternative to chemistry and physics; the data indicated many students were using this option.

While a number of schools offered advanced classes or honor classes for able students, those schools with such programs were primarily larger schools. Hence, a small sample of the schools accounted for many of the honors courses.

Use of NSF sponsored materials

Materials developed with funds from the National Science Foundation were used by over 50 percent of the schools. IPS and ESCP were the most common project materials used in the junior high school.

BSCS materials were being used in over half of the sample schools, primarily in Grade 10. Approximately 44 percent of the students reported to be taking biology were enrolled in BSCS courses. CHEMS materials were being used in 34 percent of the schools, primarily at the 11th grade level and PSSC and Project Physics were being used in 33 and 12 percent of the schools, respectively, primarily in Grade 12.

Environmental/Conservation Education (EE)

Environmental/Conservation Education (EE) was emphasized by about 63 percent of the schools. The most common approach was teaching EE with science. Some efforts to integrate EE with social studies and with other courses were reported. While most schools did not have facilities for environmental education, those that did stressed EE more in their program. In most instances, having facilities was probably the result of having active environmental/conservation education programs.

Use of supervisors and consultants

Approximately 36 percent of the schools had city or county supervisors available. About 70 percent of these staff members were science specialists. About 25 percent of the schools indicated use of state department supervisors and college or university consultants. State department personnel were used most frequently for workshops and college and university personnel for workshops and curriculum development projects.

Personal characteristics of the teachers

The teachers who were selected to respond to the questionnaire averaged between 35 and 39 years of age by region. The large majority of the teachers were male, though the ratio of females to males was considerably closer in the Southeast. Over half of the teachers had a graduate degree at the master's level or beyond.

In general, the teachers were adequately prepared in content for what they were teaching, although a number did not have broad preparation related to their teaching assignments.

While about 25 percent of the teachers had been teaching four years or less, the average teaching experience of the sample was between 10 and 11 years. Nearly all of this experience was at the secondary school level.

Attendance at National Science Foundation Institutes

Over half of the teachers in this sample had attended NSF Institutes. About nine percent of the teachers reported they had attended Academic Year Institutes, over 50 percent had attended NSF Summer Institutes; many had attended both of these and /or others such as the NSF Coop in-service program and Research Institute program. Those who had attended such institutes were more likely to be using curriculum materials developed with NSF support, to be using lab activities and to be stressing pupil centered activities.

Special facilities for science

Data were reported regarding availability and use of science facilities. Audio-tutorial labs, ventilated animal areas, greenhouses and weather stations were used frequently. Land labs received more than average use also.

Audiovisual equipment and materials

Most teachers taught in schools that appeared to be relatively well equipped with AV equipment and materials. Use varied depending primarily on teaching style, availability of software to use with some of the equipment, condition of the equipment or materials, and relative ease of scheduling the equipment.

Importance of learning activities

Lecture-discussion was ranked as the most important teaching activity, followed by group laboratory, individual laboratory and demonstrations. Other procedures were ranked considerably lower.

Satisfaction with teaching

The large majority of the sample teachers were very satisfied with science teaching as a career, though a few were not.

II. Survey of Offerings and Enrollments in Public Secondary Schools, 1972/73 (National Center for Education Statistics, 1975)

The National Center for Education Statistics (NCES) conducted a survey study for the purpose of identifying courses in different areas being offered in public secondary schools of the 50 states and the District of Columbia during the 1972/73 school year (Osterndorf, 1975).

Procedures

A stratified random sample of 8,489 schools throughout the United States offering course work in any or all of the Grades 7-12 was selected. The poplulation used for sampling was the 1971/72 universe of public secondary schools having various combinations of Grades from 7 through 12. Survey questionnaires were distributed in two basic ways: (1) direct mailing of questionnaires by NCES to local education agencies and (2) mailing of questionnaires to state education agencies for distribution and collection. Principals were asked to report courses taught and course enrollments for the 1972/73 school year.

Findings

Some of the major results with respect to science and environmental education courses are listed. Data of 1972/73 are compared to those of 1960/61 for determining increase and decrease or changes in practices.

1. Most public secondary schools offered a year each of biology, chemistry, and physics.
2. Some courses in science had more than one million

student enrollments during the 1972/73 school year. These courses were general science Grade 7, general science Grade 8, general science Grade 9, biology I and physical science I.

3. The percentage of enrollment in general science decreased, while biology enrollment increased from 1960/61 to 1972/73. The percentage of enrollments in chemistry decreased somewhat, in contrast to physics which increased.
4. Enrollment in courses dealing with conservation and the environment (environmental education, ecology, entomology, conservation, environmental science and environmental health) increased.
5. Enrollment in earth science courses (earth science, earth-space science, space science, geology and oceanography) increased from 1960/61 to 1972/73.

III. The Three NSF-Sponsored National Studies (1977)

Three national studies of major significance were conducted in 1977 with National Science Foundation (NSF) support to determine the status and needs of science, social science and mathematics education in the United States. These three studies which brought into focus the practices and conditions affecting science teaching in the United States were: (1) a literature review by Stanley L. Helgeson, Patricia E. Blosser and Robert W. Howe about the status of pre-college science education: 1955/75;

(2) a survey of school administrators, supervisors and teachers conducted by the Center for Educational Research and Evaluation of the Research Triangle Institute (RTI), North Carolina, of which Iris Weiss was project director; and (3) a number of in-depth case studies conducted in a variety of school systems, directed by Robert E. Stake and Jack A. Easley of the University of Illinois-Urbana. Each of these three studies is discussed seperately as follows:

(1) The Status of Pre-College Science, Mathematics and Social Studies Education: 1955-1975. Volume I, Science Education (Helgeson, Blosser and Howe, 1977)

The task that was undertaken was to characterize the impact of 20 years (from 1955-1975) of extensive federal, state and local funding, as well as extensive involvement and activity by professional, governmental and community personnel—all directed toward improving science, mathematics and social studies education. The survey was archival in methodology, using the ERIC data base, Education Index, Reader's Guide to Periodical Literature, Dissertation Abstracts International and books, journals, files, reports and other pertinent written materials. (Peterson and Carlson, 1977). The report was organized around four major considerations: (1) Existing Practices and Procedures in Schools; (2) Science Teacher Education; (3) Controlling and Financing Education; and (4) Needs Assessment Efforts.

Findings

The findings presented here are delimited to those related to this study.

1. Practices and procedures

(a) School organization

Enrollments in public secondary schools were increasing from 1955 until 1976. Enrollments were predicted to decline from 1977 until at least 1984 or 1985. The reduction in enrollment could cause some problems: (1) budget reductions based on enrollment; (2) need for fewer or smaller schools; (3) reduced need for some equipment and transportation items; (4) fewer students per grade and in many cases, per course; and (5) need for fewer teachers under current patterns.

Most students in secondary schools were enrolled in junior high schools with Grades 7, 8, and 9 or 7 and 8 and in high schools with Grade 10-12 and 9-12. A substantial number of students in Grades 7 and 8 were housed in elementary schools including one or more of the lower grades.

About half the schools reported grouping students for science instruction. This appeared to be most frequent in Grades 7, 8, 9, and 10. Courses at Grades 11 and 12 tended to be elective.

Secondary school science was taught primarily in departmentalized subject areas. Analyses of studies from the mid 1950's to the early 1970's indicated some use of team teaching approaches, but the individual teacher was still the primary mode of instruction in most classrooms.

(b) Curriculum material development

Development of science materials has received considerable attention since 1955. At that time the curriculum in most schools was predominantly the textbook and curricula were constructed by purchasing a series of textbooks. Data obtained from states and reviews of surveys indicate the Holt publications were the curriculum for a large number of schools in Grades 7-12; in biology, chemistry, and physics Holt dominated the market and has continued to control a strong share of the market.

Following Sputnik I, the National Science Foundation became extensively involved in development of instructional materials. In addition, The Elementary and Secondary Education Act (ESEA) and the National Defense Education Act (NDEA) provided considerable financial support for curriculum development, purchase of equipment and teacher education.

As a result of the financial support of the Federal Government, a number of projects were developed. Included among these were the Physical Science Study Committee (PSSC), Biological Sciences Curriculum Study (BSCS), Chemical Education Materials Study (CHEMS), Chemical Bond Approach (CBA), Earth Science Curriculum Project (ESCP), Intermediate Science Curriculum Study (ISCS), Project Physics, Introductory Physical Science (IPS) and others. These materials tended to show a reduced emphasis on "practical science" and emphasized concepts and processes of science. Until the early 1970's they did not reflect much emphasis on the interaction of science and society.

Concerns regarding the materials developed in the late 1950's and 1960's have led to further material development.

(c) Course offerings

The percentage of students taking science courses in Grades 7, 8, and 9 increased from 1955 through 1972 or 1973 and since that time has remained about constant. The total number of students has decreased due to declining enrollments.

The percentage of students taking science in Grades 10, 11, and 12 increased from 1955 to 1973. Data reviewed indicate a slight reduction for 1974-76.

General science was the most common course in Grade 7, 8, and 9 in the middle 1950's. Starting in the late 1950's and continuing into the 1970's there has been a consistent decline in general science courses and enrollments. The most common replacements for general science were courses in (1) life science, (2) physical science and (3) earth science; the percentage of students enrolling in these courses continues to increase.

Earth science courses experienced rapid expansion from 1955 through the 1970's leading to a shortage of qualified teachers.

Biology, chemistry and physics remained the predominant courses in Grades 10, 11 and 12, but a number of other courses such as oceanography, physiology, integrated science, and environmental science were being offered and were increasing in enrollments.

The percentage of students taking biology in Grades 10, 11 and 12 increased from 1955 through the early 1970's.

Chemistry enrollments showed a small percentage of enrollment gain in the 1960's and early 1970's. Since 1971 the percentage of students enrolled in chemistry appeared to have declined slightly.

The percentage of enrollments in physics and physical science increased slightly in the 1960's and early 1970's, but never showed a substantial increase. Since 1971 or 1972 the percentage of students studying physics and physical science has decreased slightly; the percentage of enrollment in physics has decreased more than the percentage decline in physical science.

Physical Science courses were offered in many high schools (about 50 percent in the 1960's and 1970's) for students who did not take chemistry or physics or as preparation for these courses. Enrollments in the courses increased substantially in the 1960's and early 1970's.

Percentage enrollments in advanced courses (second year biology, chemistry and physics) have shown a slow, but steady increase. Advanced biology and second year biology courses have shown the most gains. From data available it appeared that about 3 percent of the students in Grades 10, 11 and 12 were being enrolled in such courses, primarily in larger high schools.

The number of alternative materials for teaching science has increased markedly since 1955 in high schools, as in junior high schools. Courses such as integrated science, ecology, oceanography, space science, anatomy, physiology and environmental science were being offered by many schools. The variety of materials that were available placed a greater burden on the local school regarding selection and articulation.

Average and below average students have had difficulty with a number of the NSF sponsored materials. Data suggested this was due to high reading level and difficulty of some of the concepts.

About 50 percent of the students were taking no science after Grade 10. The objectives for teaching secondary school science appeared to be in transition. Increased emphasis was being given to environmental concepts, societal concerns and world problems, decision making and interdisciplinary studies.

(d) Learning activities

There was an increase in the use of student centered activity (less lecture); however, lecture discussion was the predominant method used by teachers.

Since 1955 there has been an increase in student-centered and hands-on instruction, but a substantial percentage of students were not being involved with such procedures.

While some efforts have been made to develop and use individualized and self-paced instruction (for example ISCS), a very small number of students were being exposed to these types of instruction.

Use of educational television and computers has been increasing. A number of schools have purchased or leased a minicomputer while others rely on rented time. While educational television was being used, the extent to which it was being used was very limited. Less than ten percent of the schools have used innovative practices such as modular scheduling, television, or computer assisted instruction in any consistent manner.

2. Science teacher education

Some major findings included are:

(a) While NSF and the Office of Education (OE) did offer intensive institutes in the late 1960's and early 1970's, the majority of teachers currently teaching have not participated in these.

(b) The bulk of the science instruction for the secondary program has been in the junior high school (nearly 50 percent of the students had taken no science after the tenth grade); this level had the teachers with the least adequate content preparation, poorest facilities and fewest certification programs available.

(c) Although secondary school science teachers were in the late 1970's younger and better educated than in the 1950's, there has been a need for in-service education, both as perceived by the teachers and as indicated by research.

(d) Pre-service and in-service science education needed to be viewed and dealt with as continuous program rather than as discrete entities handled by two different sets of people.

(e) Teachers were being impacted upon by the press for accountability, the back to basics movement and textbook controversies, but these were rarely the kinds of issues dealt with in their preparation.

3. Controlling and financing education

Some major findings included are:

(a) The influence of state governments on science education increased markedly since 1955.

(b) There has been extreme variation in state control and influence, but regional patterns did exist.

(c) Federal support for science education has declined since the late 1960's.

(d) Since state support tended to follow federal trends, state support for science education has also declined and is likely to continue to do so.

(e) The greatest single need facing education has been an improved program of financial support.

(f) There has been increasing emphasis on basic skills;

knowledge of science has rarely been considered basic.

(g) An important and complex need has been for equal educational opportunity.

(h) Pressure for accountability increased markedly from 1965 to 1975.

(i) Science education was rarely included in state needs statements. When it was included, it increasingly reflected concern for life skills and work skills.

(j) Nearly all states had some form of accountability or assessment procedure.

(2) The 1977 National Survey of Science, Mathematics and Social Studies Education (Weiss, 1978)

A national sample of teachers, principals, superintendents and local district supervisors, selected by the Research Triangle Institute (RTI), received survey questionnaires, as did all state supervisors of science, mathematics and social studies in each of the 50 states and the District of Columbia.

Procedures

The procedures of this study are described briefly.

Sample design

The samples were selected using a multistate stratified cluster design. First, approximately 400 public school districts were selected from 102 different geographic areas across the country. Next, schools within these districts were selected to provide a total of approximately 400 schools at each of four grade levels: K-3, 4-6, 7-9, and 10-12. Finally, teachers within each sample school were selected from a list provided by the principal. Six teachers--two in each subject--were selected from each 7-9 and 10-12 sample school.

Instrument development

The National Science Foundation had defined the areas of interest for this survey to include course offerings, curriculum usage, and classroom practices in science.

Date collection

The Chief State School Officers in the states with sample schools were asked for permission to contact sample districts in their states. District superintendents were subsequently contacted and, after they had granted permission, questionnaires were mailed to teachers, principals and local district supervisors. In districts with no district supervisors in one or more suject areas, the superintendent was asked to designate a person to answer questions about district programs.

Follow-up activities used to increase the response rates included the use of Thank-You/Reminder postcards, a second questionnaire mailout, mailgrams and phone calls. The resulting response rates were 90 percent for state supervisors, 73 percent for superintendents, 72 percent for district supervisors, 84 percent for principals and 76 percent for teachers.

Findings

The findings presented here are delimited to those related to this study.

1. Federally-funded curriculum materials

(a) Attendance at NSF-sponsored institutes, conferences and workshops

About one third of the science teachers of junior high schools and almost half of high school science teachers have participated in at least one such activity. NSF Summer Institutes and In-Service Institutes, both offered prior to 1974 only, served the largest numbers of teachers. The percentages attending NSF activities since 1974 were lower because relatively few teachers have had the opportunity to participate in these activities in later years.

(b) Use of federally-funded curriculum materials

About 30 percent of the junior high school science teachers (7-9) and slightly more than half of all Grades (10-12) science teachers were using one or more of the federally-funded science curriculum materials during the 1976-77 school year. Data also showed that some of these materials were used by about five percent of school districts (Grades 7-12) in 1967-77. The percentages of the usage of these materials in the sample school districts were 25 percent for IPS, 19 percent for BSCS Green, 16 percent for BSCS Yellow, 15 percent for CHEM Study, 12 percent for ISCS, 12 percent for Project Physics, 11 percent for PSSC Physics, 10 percent for ESCP, 8 percent for BSCS Blue, 7 percent for ISIS and 6 percent for Biological Science: Patterns and Processes.

(c) Superintendents' opinions about federal support for curriculum development

While 58 percent of superintendents agreed that federal support for curriculum development and dissemination has improved the quality of curriculum alternatives available to schools, only 27 percent believed that these efforts have greatly improved the quality of classroom instruction. Most superintendents (66 percent) believed that continued federal support for curriculum development during the next ten years was necessary, with 77 percent feeling that NSF should continue to help teachers learn to implement NSF-funded curricula, and 55 percent believing that the federal government should direct more attention toward disseminating the new curricula.

2. Science teachers

(a) Teachers' qualifications

More than half of the secondary school science teachers held degrees beyond the bachelor's degree. Only 15 percent of all secondary school teachers repondents reported teaching courses outside the field in which they received their primary training.

(b) Areas of assistance

Teachers were asked to indicate specific areas in which they would like assistance. More than 75 percent of all science teachers indicated they did not usually need assistance in lesson planning, acutally teaching lessons and maintaining discipline. Areas in which a sizable number of teachers would like additional assistance included obtaining information about instructional materials, learning new teaching methods, implementing the discover/inquiry approach and using manipulative or hands-on materials.

(c) Sources of information

Teaches were also given a list of possible sources of information about new developments in education and were asked to rate the utility of each. The results showed that many science teachers relied on other teachers for information; approximately half of them rated this source "very useful" while most of the others considered teachers "somewhat useful." Other particularly valuable sources of information for teachers included: journals and other professional publications and college courses. The majority of teachers rated teacher union meetings and state department personnel as "not useful."

3. Instructional materials and techniques

(a) Instructional materials

The textbook continued to play a central role in science. While most classes used a single textbook or program, approximately one-third used multiple textbooks. In most districts, teacher committees and individual teachers were heavily involved in selecting the textbooks to be used. In many cases principals, superintendents and district-wide supervisors were also involved in these decisions. Very few districts involved students, parents or school board members to any great extent in the textbook selection process.

(b) Learning techniques

Lecture and discussion were the predominant techniques used in science. Discussion occurred "just about daily" in half or more of these classes. Approximately two-thirds of the classes in science had lecture once a week or more, with many of these having lectures "just about daily."

Televised instruction, programmed instruction, computer-assisted instruction and contracts were rarely used in science. The situation with regard to audiovisual aids was only slightly better.

The use of "hands-on" or manipulative materials was most frequent in science classes, with 48 percent of the classes using them at least once a week. Interestingly, science teachers who have attended one or more NSF-sponsored activities were considerably more likely than other science teachers to use manipulative materials in their classes.

4. Facilities, equipment and supplies

Principals were asked if each of a number of types of equipment was available in their schools. The results indicated that high schools were considerably more likely than junior high schools to have greenhouses, computers or computer terminals, hand-held calculators, or darkrooms.

Teachers were asked about the actual use of various types of equipment. The results showed that some types of equipment were available in many schools but were used in relatively few classes.

5. Factors which affect instruction in science

Four problems were regarded as serious by more than 20 percent of secondary school science teachers (Grades 7-12):

(1) insufficient funds for purchasing equipment and supplies; (2) inadequate facilities; (3) lack of materials for individualized instruction; and (4) inadequate student reading abilities.

(3) Case studies in Science Education (Stake and Easley, 1978)

Case Studies in Science Education (CSSE) is a collection of field observations of science teaching and learning in American public schools during the school year 1976-77. It was organized by a team of educational researchers at the University of Illinois and other consultants hired to assist them in various activities.

Procedures

The procedures of the CSSE case studies are described briefly:

Eleven high schools and their feeder schools were selected to provide a diverse and balanced group of sites: rural and urban; east, west, north and south; racially diverse; economically well-off and impoverished; constructing schools and closing schools, innovative and traditional. They were finally selected so that a researcher with ample relevant field experience could be placed at each. To confirm findings of the ethnographic case studies and to add special information, a national stratified-random-sample of about 4000 teachers, principals, curriculum supervisors, superintendents, parents and senior class students were surveyed. Survey questions were based on observations at the eleven case study sites.

The field researchers were instructed to find out what was happening, what was felt important, in science (including mathematics and social science) programs. On site from 4 to 15 weeks they were not required to coordinate their work with observers at other sites. Questions orginally indicated important by the NSF or identified early in the field were "networked" by the Illinois team. Efforts to triangulate findings were assisted by reports of site visit teams.

Findings

The findings for the CSSE case studies and other date-gathering efforts which are related to this study are summarized as follows.

1. Teacher's role

The role being played by teachers in setting purpose and quality of the science programs was apparent. The "teacher was the key" in all case studies and reaffirmed in the survey.

2. Basics

Teachers appeared to be fully convinced that improvement in all education, including science education, was directly dependent on improvement in reading.

3. Science curricula

Most high school science departments were offering biology for all students and either chemistry or physics, or both, for the student going on to college. Home economics, still largely for girls, and agriculture, largely for boys, included science topics, but were not coordinated with the science offerings. Laboratory work in several sites appeared to be diminishing in importance because of the expense, vandalism and other control problems and the emphasis on course outcomes that would show up on tests. A general science course was a standard offering in junior high schools almost everywhere.

4. Text-bound teaching

The predominant method of teaching science was recitation, particularly in the junior high school. The high school class was more likely to use some workbook exercises, possibly in groups at the lab tables--but the emphasis was still on recitation, with the teacher in control, adding new information and sometimes demonstrating. The textbook was the key to the information.

5. Articulation and uniformity

All in all, there was extremely little articulation in the science curricula among different schools in a district, either between levels (middle, and secondary) or between school buildings at the same level. There was a little more articulation across classes within a school building but there, too, teachers supported the uniqueness of each teacher's approach as long as it did not get them all into trouble.

6. Low priority for science education

About half of the respondents agreed that "the general public does not put high priority on the teaching of science." About one-third disagreed.

7. Curricular materials

Textbooks were central to instruction in almost all classes. The texts used in science was frequently criticized as having too difficult a reading level. Restricted budget had caused postponement of purchases in many districts, but poor purchasing in the past left many usable materials unused in all classes.

8. The role played by parents, teachers, students, school board members in the review, selection and use of science curricular materials

The circumstances varied from place to place. Usually the larger the place, the more that was decided at the district office, within the choices allowed by the state. But many individual teachers were finding a way to obtain the materials of their choice among those permitted by ordinary expense limits. Parents usually got involved only when something went wrong. Students had no role except indirectly as their complaints about texts and other materials were taken seiously by teachers. School boards took the advice of teachers and administrators. The people most interested in curricular choices got involved in "curriculum guides." Many teachers ignored the guides or berated them, but central office personnel often displayed them with considerable pride.

9. The use of out-of school resources in conjunction with science curricula

Out-of school resources were seldom used. Emphasis on the basics and preparation for testing created doubts about the value of out-of-school resources.

10. The perception of students, parents, teachers and administrators of the effectiveness of science education efforts

Almost all members of these groups rated the science education efforts as satisfactory or very good.

11. Special efforts set aside for those students skilled or highly interested in science, for non-reading or nonmotivated students

There were signs of new attention to the "gifted child," but in general, attention for ten years had been directed to the "less gifted." Actually, very few special efforts, other than separation and changing-of-pace were noted for either the more able or less able students.

12. Types existing of local in-service training programs

Staff meetings, district conferences and university courses were most common. Most schools had in-service workshop days a couple times a year, organized and staffed by district personnel and consultants. Participation was high in most places. The teachers found them more valuable for opportunity to talk with other teachers than for help they got from specialists. In-service leadership by master teachers was sought. NSF institutes were praised. Many teachers had problems they were not getting in-service help for.

13. Barriers existing to improve science education at the local level as perceived by students, teachers, administrators, school boards, supervisors and parents

The one largest barrier seen by all groups was: student behavior, particularly student motivation. Financial barriers were often mentioned. Complaints of teachers (heard but often misunderstood by supervisors and others in the support system) indicated dissatisfaction with materials that did not conform to their responibilities for socializing the youngster. Many students found the courses boring. Across the board, there was not a strong feeling that improving science education was high on the priority list.

14. Problems

The CSSE project found that the most serious problems in science teaching and learning in the American schools are:

(a) The proportion of school funding spent for instruction has been diminishing at a distressing rate.

(b) There was a diminished concern for scientific ideas, such as Newton's laws and homeostasis, as central to instruction in science. Replacing the emphasis on fundamental relationships were: topics of a scientific or technological aspect, such as environmental pollution, animal behavior and space exploration. But even those were giving way to emphasis on fundamental learning skills, such as reading, arithmetic and spelling.

(c) The pedagogical support for teachers was poor in relevance and small in quantity. Though they did not complain much, teachers had few resources for assistance in teaching difficult subject matter or in teaching children who had trouble learning.

(d) Opportunities to learn science out-of-school were not sufficiently supported by teaching in the schools. Many teachers, for example, did have children watching National Geographic television shows, purchasing hand calculators and visiting local industries, but many did not. There was little official reward to the teachers who were encouraging youngsters to incorporate into their formal education learnings from the rich environment around.

(e) The quality of reading and other "basic" performances of students was too low.

(f) There was little articulation regarding instruction across classrooms within a building, across buildings, and across levels of instruction, from elementary to high school. But there were very few subject matters for which the teaching actually depended on a high degree of articulation.

Summaries and synthesis of the three NSF studies

A number of groups have used these three studies to identify status and desired changes in science education. Among these groups are DeRose et al. (1979) and Project Synthesis (Harms and Kahl et al., 1980; Harms and Yager, 1981). The final materials of Project Synthesis were not available when this section was written: however, information from the draft report is consistent with previous studies.

Summary

These studies provide an indication of general changes that have taken place in teaching science in secondary schools. No extensive surveys involving longitudinal data (other than the OSU studies) were identified. This study will provide information on changes from 1970-71 to 1979-80 in specific school buildings. It will help add to existing literature and provide information to help interpret the changes in practice. Chapters four and five include some comparisons between conditions reported in the earlier studies and this 1979-80 study.

Reviews Related to the Process of Educational Change and the Factors Influencing it.

Extensive work and research related to the process of educational change has been done in recent years. The purpose of this section is to: (1) list several reviews of change literature; (2) present selected studies that appear to be relevant; and (3) present a summary from the literature of some theories or findings which are related to this study.

Research Studies and Selected Reviews of Research on Change Literature

Listed below are selected research studies and research reviews: Berman and Mclaughlin (1974), Berman and Pauly (1975), Greenwood et al. (1975), Berman and Mclaughlin (1975), Berman et al. (1975), Berman et al. (1977), Berman and Mclaughlin (1978), Sikorski et al. (1976), Clark and Guba (1974), Wirt (1977), Hall et al. (1975), Baldridge and Deal (1975), Zaltman et al. (1977), Baldridge and Johnson (1972), Emrick and Peterson (1977), Emrick et al. (1977), Schlesser et al. (1971), Yegge et al. (1971), Nelson (1975), Ogletree (1979), Pearson and Fuller (1969), Fuller and Pearson (1969), Lawyers' Committee for Civil Rights Under Law (1974) and Hayas and Ross (1976).

Studies Related to Change

Selected research studies related to the process of change and innovation are described. These studies are:

I. Rand Study: Federal Programs Supporting Educational Change (Berman, Mclaughlin, Pauly, Greenwood and others, 1973-1977)

The Rand Corporation conducted, under the sponsorship of the U.S. Office of Education, a four-year, two phase study of federally funded programs designed to introduce and spread innovative practices in public schools. These change agent programs offered temporary federal funding to school districts. It was assumed that districts would incorporate and spread part or all of the project using other sources of funds later. Generally, the Rand Study analyzed the effects these federal policies have had on local change processes.

Design

The Rand Study viewed change or innovation as a process of the following three stages: (1) initiation (adoption or mobilization); (2) implementation; and (3) incorporation (institutionalization).

The first phase (July 1973 to July 1975) studied local innovations during their last or next to last year of funding by federal change agent programs and the research focused on the initiation and implementation of these local projects. Specifically, this aspect of the study identified what kinds of strategies and conditions tended to promote change in the school and which did not.

Phase II of the study (May 1975 to April 1977) examined what happened to selected projects after the end of the federal funding period (of three to five years). This phase focused on different forms that local incorporation or continuation were taking and analyzed the institutional and project factors that promoted or detered the sustaining and spreading of the change projects.

Findings

A summary of the findings for phase I and phase II was presented by Berman and Mclaughlin (1978).

Phase I

Federal change agent policies had a major effect in stimulating the local education agencies (LEAs) to adopt new projects, but neither those policies that were unique to each of the federal programs nor those policies that were common to them had a strong influence on the implementation of local innovations.

Federal change agent policies exercised limited leverage on the course of innovations because they did not critically influence those factors most responsible for effective implementation. A project's educational effectiveness did not depend much on its amount of funding.

Phase II

Three main factors affected the local process of change and thus the outcomes of innovation:

1. Project characteristics, particularly the educational methods (also called treatment or educational technology) used and the scope of change planned or implied by the project relative to its setting.
2. The implementation strategy employed by local innovators to install the project treatment.
3. Characteristics of the institutional setting, particularly the organizational climate in schools, the quality of working relationships among teachers, the active support of principals, the effectiveness of project directors and the motivations of participants at all levels.

II. Factors Influencing School Change. Science, Mathematics and Social Science (Sikorski et al., 1976)

This study on the process of change and effects of educational change efforts was based on a review of research and on informed opinions of mathematics, science and social science educators. The study report included five chapters.

Chapter one presented selected models for the change and innovation processes. Chapter two described environmental, organizational and individual influences on the change process. Chapter three discussed change strategies which have been tried and studied and reports on their effects. Chapter four discussed change strategy evaluation. Chapter five presented research recommendations. In addition, the sources of data and information which included bibliographic references and names of individuals and agencies were presented.

Conclusions

Some conclusions are selected and presented here. These selected conclusions are delimited to those related to this study.

1. A model (Figure 2.1) was developed to show various stages of the innovation process where responsibilities are divided between federal and local levels.
2. The political, economic and legal environment of schools affect the success of curriculum change strategies.
3. Organizational (school and district) conditions determine the nature of innovative processes in these organizations.
4. The principal and the teacher have the most crucial roles in change

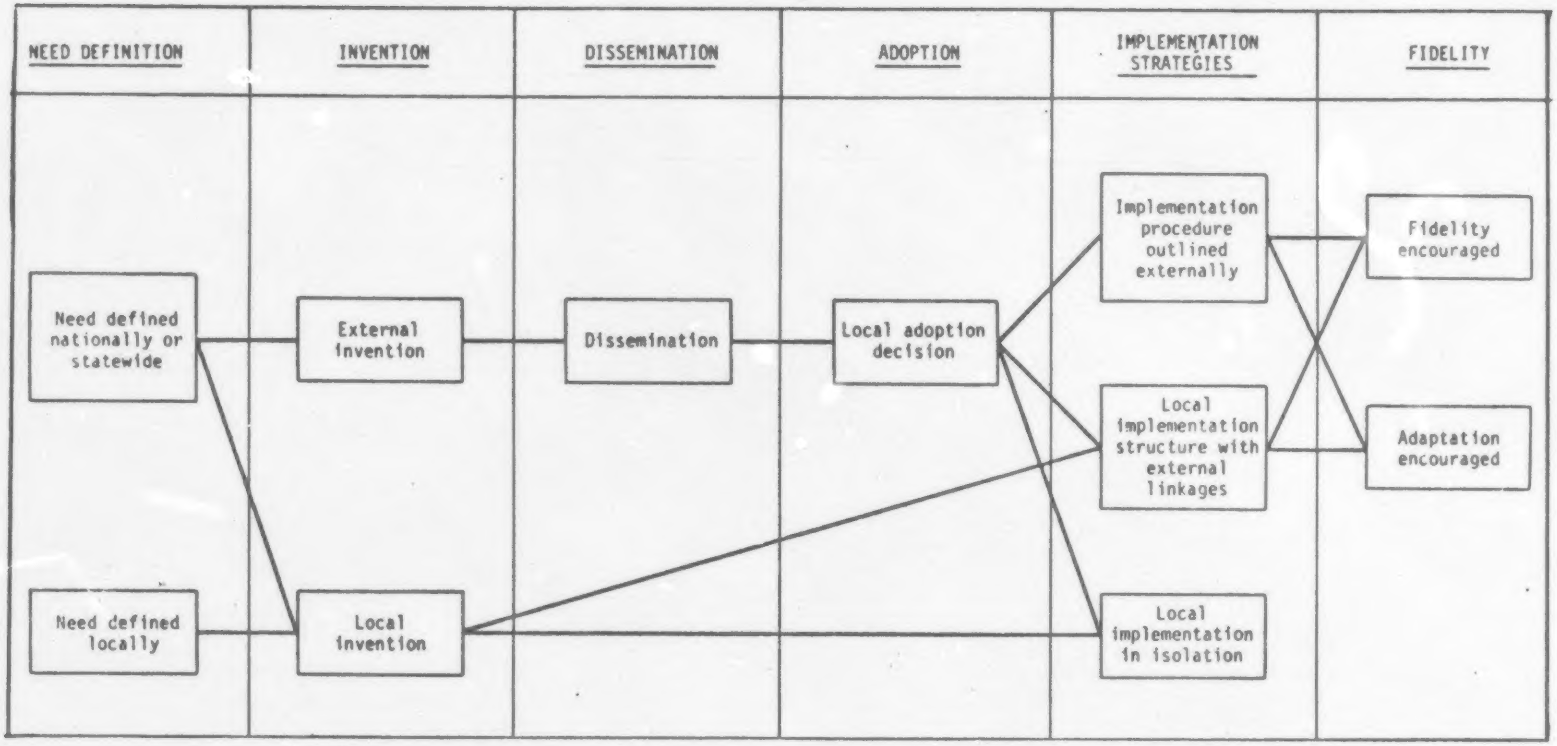
NEED DEFINITION
INVENTION
DISSEMINATION
ADOPTION
IMPLEMENTATION STRATEGIES
FIDELITY
Need defined nationally or statewide
Need defined locally
External invention
Local invention
Dissemination
Local adoption decision
Implementation procedure outlined externally
Local implementation structure with external linkages
Local implementation in isolation
Fidelity encouraged
Adaptation encouraged

FIGURE 2.1

ALTERNATIVE PATHS TOWARD INNOVATION

5. Curriculum development and implementation strategies affect change.
6. Strategies of disseminating information about innovative curricula or relevant to the use of innovative curricula affect change.
7. Meaningful change takes time and considerable effort.
8. Intangible professional or psychological incentives are more effective in soliciting teacher cooperation and involvement than are more tangible incentives.

Recommendations

Recommendations for needed research were presented. A summary of these recommendations are: (1) researchers and practitioners need to share and use their present knowledge about change strategies; (2) researchers should conduct field trials, continue to seek models of change, gather more trustworthy information on outcomes and remain clear about the differences among goals; and (3) new strategies that might further adaptive modifications should be explored.

III. A Study of Innovation and Change in Education. The Regional University-Schools Research and Development Program. An Action-Research Project (Schlesser et al., 1967-1971)

This action-research project was conducted by Colgate University, Hamilton, N.Y., in conjuction with public secondary schools in the region. The major overall research objective of the project was to study community and school forces impeding and facilitating change in attitudes, availability and usage of 31 innovations in 26 selected secondary schools.

Design

Six criteria were employed to measure innovation and changes in innovation in the 26 selected schools. (1) faculty attitude toward innovation; (2) change in faculty attitude toward innovation (from 1968 to 1970); (3) availability of innovations in each school; (4) change in availability of innovation (1968 to 1970); (5) Usage of innovations in each school; and (6) change in usage of innovation in each school (1968 to 1970).

Pre- and post-survey measures were obtained for each of the criteria and for each independent variable (school and community force).

Findings and Conclusions

1. Among the most important forces making for differences in gain in school attitudes toward innovativeness were: (a) the institution climate, especially with respect to openness; (b) the influence of the innovating teacher; and (c) the attitude of the faculty toward change.
2. Forces influencing schools to gain most in availability were restricted primarily to board members and faculty.
3. Forces influencing schools to gain more in usage were the Colgate project, administrative leadership and the extent to which the school staff personally used innovations.

IV. Evaluation of the Natural Diffusion Network (NDN) (Emrick et al., 1977)

This study was conducted by Stanford Research Institute (SRI) with the support of the Office of Education (OE) for the purpose of evaluating the effectiveness of NDN organization, processes and outcomes during the 1975-76 school year. Briefly, the evaluation focused on several major categories of issues, ranging from examination of the organizational structure and operational effectiveness of the NDN as a "national system" to documentation and characterization of the diffusion process and adoption consequences.

The final report on SRI's evaluation of the NDN has been prepared in two volumes. Volume one presents the major findings of the evaluation and implicaitons of these findings for future federal dissemination and diffusion activities. Volume two describes the technical details of the evaluation methodology and analysis procedures employed and presents statistical data obtained from the evaluation surveys of NDN participants.

Design

The NDN used a three stage diffusion process similar to the three stages used by the Rand Study. The stages were: initiation, implementation and assimilation. Briefly, the initiation stage included those activities intended to inform LEAs of the innovations, to build local interest in adoption of one or more programs, and to prepare LEA personnel to undertake implementation, or actual use of the innovation in their schools and classrooms. Assimilation is the process by which the innovation becomes a regular part of the school's organization or curriculum. Only the first two stages required active participation by the NDN.

Data were collected for this evaluation using document and literature, reviews, survey questionnaires, site visits, interviews and observation.

Findings

Some of the findings related to this study are presented:

1. The majority of NDN adoptions occured within a rural or suburban school.
2. Adoptions tended to involve implementation of low to moderate organizational impact.
3. Successful implementation required a strong local leader and administrative concurrence.
4. Most adoptions involved some modification of methods and materials
5. The implementation process was gradual and cumulative.
6. Materials played a crucial role in supplying the operational and instructional detail of the NDN innovations.
7. Follow-up visits represent a distinctive and important feature of the NDN strategy.

V. Analysis of State Authority for 1972 -73 on 36 Areas of Educational Policy and on Centralization of Authority. (Wirt, 1977)

Wirt (1977) explored the extent of differences among the 50 states in the degree of centralization of control over local school policy by the state government. Wirt used the content analysis of the laws of the 50 states in 36 areas of educational policy. The analyses were performed during 1972-73 by the Lawyers' Committee for Civil Rights under a grant from the National Institute of Education. Content analyses were made of the statements of legal authority over schools in the policy areas, covering each state's constitution, status, court decisions and administrative regulations.

The central measure of this study was the centralization of authority over educational policy. Centralization was conceptualized as a variable that ranges from full state decentralization at one end of a continuum to full state centralization at the other end. Seven logical categories of centralization on which a given policy might be judged were used:

0. Absence of State Authority
1. Permissive Local Autonomy
2. Required Local Autonomy
3. Extensive Local Option Under State Mandated Requirements
4. Limited Local Option Under State Mandated Requirements
5. No Local Option Under State Mandated Requirements
6 Total State Assumption.

A total State Centralization Score (SCS) ranging from 0.00 to 6.00 was given for each policy area for each state. The results show that there was considerable variation among the states, ranging from a SCS of 1.86 for Wyoming to a SCS of 6.00 for Hawaii. There appear to be three patterns of states regarding centralization patterns: (1) states with substantial decentralization or centralization; (2) states moderately decentralized or centralized; and (3) states that are intermediate.

VI. A Study of State Legal Standards for the Provision of Public Education (Lawyers' Committee for Civil Rights Under Law, 1974)

This study was conducted by the Lawyers' Committee for Civil Rights Under Law and funded by the National Institute of Education.

The purpose of the study was to collect, categorize and compare law on elementary and secondary education in all 50 states.

Design

Materials were collected from states of the school laws, rules and requirements of the state board or state department of education and any other administrative materials interpreting or supplementing the legislation. After the materials had been assembled, they were analyzed in 37 areas. These areas covered a wide range of subjects that are important elements in defining an adequate education.

For the 37 areas investigated,20 charts were constructed comparing all the states in 20 of those areas. There were several considerations which led to the selection of the 20 areas in which the charts were developed.

These charts should answer four questions about the requirements in that area of the education system.

1. By what authority are these requirements established?
2. Who determines these requirements?
3. Who executes these requirements?
4. What are the specific requirements?

Findings

A summary of the findings in some areas related to this study are presented.

1. Curriculum

In all states the local district must offer a curriculum that the state prescribes. The degree of control exercised by the education agency differs from state to state. In about half the states a local district must offer the curriculum devised by the state. In three of the states (Alabama, Mississippi and Utah) the curriculum is decided by a state committee other than the education agency; in all others, the education agency formulates the the requirements. Even in those states where districts retain some direction, course offerings must still be chosen within state guidelines. Sometimes the guidelines are legal requirements that the district must observe. The statutes of nearly all states contain such requirements.

Some states require that a district must offer a specified number of courses. Some also enforce the dictates of the education agency by making the district's choice of curriculum a requirement for accreditation. Sanctions for non-compliance would include non-recognition of the district or school and/or loss of state aid.

2. Inservice Training

In most of the states that have inservice training, the training takes place on the district level. Only about half the states have developed statutes or regulations dealing with training programs. The net result is that very few states have a broad and well-developed program of inservice training.

3. Textbooks

The adoption of textbooks occurs at the local level and the decision process is usually subject to some state restrictions. In most states the district board selects its textbooks from a list prepared by the state education agency. This state approved list contains recommendations for several books for each course rather than a specific book for each course that must be adopted.

Several states which use the state approved list allow the district board to adopt supplementary texts for a course if they follow certain state standards.

Conclusions

The Lawyers' Committee concluded the following:

1. The role of the state legislatures and educational agencies, in most instances, has been less potent than one might imagine in developing and enforcing legal standards for quality education.
2. Relatively few states had constructed any kind of consistent and coherent state-wide scheme for developing public education services on a basis that could be considered equitable, efficient and effective.
3. It seems obvious from this study that in most states, the major decisions affecting the quality of a particular child's education are made, not in the state capitol, but in the offices of the local education agencies.

VII. The Status of State-Legislated Curricula in the United States (Ogletree,1979)

This survey was conducted in 1977-78 on the legislated curriculum in 50 states. The purpose of the survey was to determine who prescribes and controls school curriculum at the local level (whether the state or local school boards) and how much and what type of elementary and secondary school curricula have been legislated by the states.

Data

Data were obtained from the school law publications of each state. The completed list of legislated subjects was then sent to the respective state school superintendents for confirmation.

Findings

A summary of the findings related to this study, are presented.

1. A total of 116 subjects have been legislated by the 50 states. The highest percent of subjects legislated were in the areas of personal health and welfare and national and state government.
2. Forty-nine states had legislated or prescribed curriculum. Montana legislature did not prescribe curriculum.
3. Health education (58 percent), alcohol and narcotics (68 percent), hygiene (40 percent) and safety (36 percent) were given relatively high priority. Only 24 percent of the states had legislated drug education and tobacco education, and only 20 percent sex education.
4. The percentage of states mandating new subject areas was

relatively low. Metric education (40 percent), driver education (24 percent), conservation education (16 percent), consumer education (16 percent), family education (6 percent), and sex education (2 percent) were not given high priority by state legislatures.

5. Iowa and Georgia had the greatest number of legislated subjects (43 and 37 respectively), followed by New York (36) and Wisconsin (35). Nineteen states had legislated 20 or more subjects and 19 had fewer than 10 mandated subjects.

6. States with the smallest number of mandated subjects tended to prescribe nonacademic subjects (e.g., career education, consumer education, health, nutrition and physical education, alcohol and narcotics) that prepare students for life and careers.

7. Seven states (Iowa, Georgia, New York, Wisconsin, California, Indiana and Texas) which had mandated from 43 to 31 subjects respectively, appeared to have a sufficient variety of subjects to meet the requirements of a modern and relevant curriculum.

8. Despite the disparity in statutory curricula from state to state, there was considerable national uniformity. The trend toward a national system may be growing. A number of facts were found to support this hypothesis:

   (a) increasing influence of federal government in state and local education policies, e.g., the Department of Health, Education, and Welfare and the federal courts;

(b) strengthening of the state departments through federal funding under the Elementary and Secondary Act;

(c) state legislatures abdicating their legal educational obligations to state departments of education;

(d) growing support for a national public employee collective bargaining bill that would reduce state roles in teacher certification, pension and salary; and

(e) influence of the National Assessment of Educational Progress on state curricula and funding.

Conclusion

It was concluded that control of the schools will increasingly center in state departments of education not in local school districts. In turn, the state departments will come under the influence of the federal government through funding of categorical programs and court decisions. This trend, however, may bring about a more equitable and higher-quality education for all children, irrespective of ethnic and socioeconomic background and residence.

Summary of Findings of Change Studies

From the literature major theories or findings for the change process are presented in the following statements. After each statement there is a code to indicate how the statement relates to this study. The nine categories used are:

1. School organization
2. Personnel
3. Principal
4. Teachers

5. Curriculum
6. Materials and Facilities
7. Implementation
8. Information Dissemination
9. Regulations (State and Federal)

Most of these statements are conclusions based on the analysis of a number of research studies. Few are conclusions by single reviewer. These statements are:

> Characteristics of the institutional setting, particularly the organizational climate in schools, the quality of working relationships among teachers, active support of principals and the motivations of participants at all levels of the district are major factors which affect the local process of change and the outcomes of innovations (Berman et al., 1977; Sikorski et al., 1978; and others). (1,2,3,4)
>
> The type of school had little or no relationship to change outcome (Berman and Mclaughlin, 1978; Sikorski et al., 1976; and others). (1)
>
> Certain demographic characteristics are correlated with adoptions of new curricula. This includes size (Deal et al., 1975; Baldridge, 1974; Berman and Pauly, 1975); location operationalized as environmental heterogeneity (Baldridge, 1974; Berman and Mclaughlin, 1975) and as opportunity for interaction (Havelock, 1969; Fullan and Eastabrook, 1973; House, 1974), past experience with innovations (Widmer, 1975; Baldridge, 1974; Deal, 1975; Berman and Pauly, 1975). (1,2,3,4,5)

Flexibility is an important aspect of organizational climate for adopting new curricula (Rogers and Shoemaker, 1971; Turnbull et al., 1974; Wirt, 1976; Sikorski et al., 1976; and others). (1,2,5)

The innovativeness of an organization is a function of the capability and motivation of its members implementing change (Bredo and Bredo, 1975; Zaltman et al., 1977; Schmuck et al., 1975; Sikorski et al., 1976; and others). (1,2)

The characteristics of the principal and of individuals in other leadership roles influence the innovativeness of school organizations (Manning, 1974; Havelock, 1969; Zaltman et al., 1977; Fullan and Pomfret, 1975; Hall and Alford, 1976; Carlson, 1965; Sikorski et al., 1976; and others). (1,2,3)

The awareness of the need for change or innovation of the members of an organization is important for planned change to occur (Zaltmen et al., 1977; and others). (1,2,3,4)

A change agent role as part of the organizational structure of school systems can be an important factor for introducing and promoting changes (Carlson, 1965; Gallaher, 1975; Baldridge, 1974; Knight and Gorth, 1975; House, 1975; Sikorski et al., 1976; and others). (1,2)

Incentives are found to be important for creating a favorable climate in school organizations for change (Zaltman et al., 1977; Stiles and Robinson, 1973; Rogers,1976; Sikorski et al., 1976; and others). (1,2,3,4)

The relationship between schools and the public provides administrators with more incentives for cosmetic changes than for fundamental ones (Pincus, 1974; Miles, 1965; Sieber, 1968; Nelson and Sieber, 1976; Sikorski et al., 1976; and others). (1,2,3)

Interstaff support and exchange, both horizontal and vertical, are found to be important for creating a favorable climate in school organizations for change (Berman and Mclaughlin, 1975; Manning, 1974; Cooke et al., 1974; Edelfelt and Johnson, 1975; Sikorski et al., 1979; and others). (1,2,3,4)

Persons involved in change, administrators, teachers, board members and community leaders should feel that the innovation is their own-not one devised and operated by outsiders (Watson, 1974; Zaltman et al., 1977; and others). (2,3,4)

Special incentives are important to motivate teachers, administrators and other staff to use internal and external resources of change knowledge (Zaltman et al., 1977; and others).

(1,2,3,4,6,8)

The school principal can be a critical force in facilitating innovation. A principal's own desire for change and positive attitude toward change and those who want to change can greatly facilitate the effort (Anderson and Horn, 1972; Barth, 1972; Devaney, 1974; Berman and Mclaughlin, 1975; Chesler et al., 1975; Schmuck et al., 1975; Turnbull et al., 1974; Parkay, 1976; Sikorski et al., 1976; and others). (2,4)

Involving teachers in decision making, or turning the authority over to them, can help insuring that the change itself is reasonable and appropriate to the reality they face (Sikorski et al., 1976; and others). (2,4)

The isolation of teachers is cited as a major reason for the slowness of schools to innovate (Schmuck et al., 1975; House, 1975; Sikorski et al., 1976; and others). (1,2,4)

For individuals trying to implement an innovation, there is support in numbers. Programs that involve a number of people rather than scattered individuals have a greater chance of success; the supportive group seems to form a "critical mass" (Greenwood et al., 1975; Rogers, 1976; Drumm, 1976; Turnbull et al., 1974; Sikorski et al., 1976; and others). (2,3,4)

High school teachers may be less responsive to change efforts than elementary teachers (Mann, 1976; Fullan and Pomfret, 1975; Rogers, 1976; Sikorski et al., 1976; and others). (2,4)

Innovation has a greater chance of success in schools where the principal encourages open communication and sharing in decision making (Parkay, 1976; Schmuck et al., 1975; Sikorski et al., 1976; and others). (1,2,3)

The teacher is a crucial factor in the success or failure of an innovation. Teacher resistance can be fatal to change, and teacher support of an innovation is an important facilitator (Parkay, 1976; Nygren, 1976; Yegge et al., 1971; Sikorski et al., 1976; and others). (1,2,4)

Teacher competency is crucial to successful implementation of change and trying new ideas (Fullan and Pomfret, 1975; Berman and Mclaughlin, 1975; Gross et al., 1971; Sikorski et al., 1976; and others). (1,2,4,5)

User-commitment and capability are neccessary for educational change, and these appear to depend on meaningful user participation in decision making (Fullan, 1972; Sikorski, 1975; Fullan and Pomfret, 1975; Sikorski et al., 1976; and others). (1,2,3,4)

It is felt that the decision-making process should involve not only members of the educational system concerned, but also members of that system, environment who have potential for facilitating or blocking the change effort (Zaltman et al., 1977; and others). (1,2,3,4)

Curriculum materials developed at the local level appear to be more responsive to user wants and needs (Berman and Mclaughlin, 1975; Mclaughlin, 1976; Sikorski et al., 1976; and others). (5,6)

It is felt by some that an alternative to local curriculum development can be by continuing centralized (federal) curriculum development, but with improved mechanisms for feedback from potential users (Turnbull et al., 1974; Rosenau and Hood, 1975; Bezuszka, 1975; Sikorski et al., 1976; and others). (5,6)

Outside funding or assistance for finding supplementary money is frequently necessary to relieve the burden of supporting innovation (Turnbull et al., 1974; Anderson and Horn, 1972; Whitla and Pinck, 1973; and Sikorski et al., 1976; and others). (5)

Schools and districts may be hampered by materials and equipment (Turnbull et al., 1974; Whitla and Pinck, 1973; Anderson and Horn, 1972; Sikorski and Hutchins, 1974; Sikorski et al., 1976; and others). (6)

The high costs of change is often considered as an impediment (Turnbull et al., 1974; Sikorski and Hutchins, 1974; Sikorski et al., 1976; and others). (6)

Curriculum change generally depends on inservice training for practicing teachers (Ornstein, 1976; Fullan and Pomfret, 1975; Taylor, 1975; Sikorski et al., 1976; and others). (2,4,5,7)

Implementation strategies emphasize the need for training of teachers to accompany the use of innovative materials (Turnbull et al., 1974; Sikorski, 1975; Greenwood et al., 1975; Hall, 1974; Fullan and Pomfret, 1975; Anderson and Horn, 1972; Piburn, 1972; Whitla and Pinck, 1973; and others). (2,4,5,6,7)

It is felt that at least part of the training available to teachers should go beyond use of specific materials and into broader skills (Bracht et al., 1973; Willson et al., 1974; Greenwood et al., 1975; Gibney, 1971; Howe, 1974; Sikorski et al., 1976; and others). (2,4,6)

It is felt that preservice education has limited effectiveness for curriculum change, although it provides a broad training experience (Zaltmen et al. 1977; Mann, 1976; Sikorski et al., 1976; and others). (2,4)

It is the organization rather than the individual teacher who should be the target of training (Schmuck et al., 1975; Zaltman et al., 1977; Parkay, 1976; Sikorski et al., 1976; and others). (1,2,3,4)

Special training of potential users is often needed for successful implementation of significant change (Zaltman et al., 1977;

and others). (2,3,4,7)

The limited success of curriculum developments has been largely attributed to the developers' failure to consider mechanisms for dissemination, servicing, and implementation assistance necessary for schools to use their products (Sikorski et al., 1976; and others). (2,3,5,6,7,8)

To prevent some forms of resistance, the nature of the change and the required behavior for initiating and implementing the change should be made clear to those involved in the change process (Zaltman et al., 1977; and others). (1,2,3,4)

The role of information strategies for increasing curriculum uses is limited, but it is important (Hood, 1974; Sikorski et al., 1976; and others). (5,8)

There is evidence that personal communication may be more important than written materials in bringing about educational change (Wolf,1973, Rogers et al.,1976; Sieber et al., 1972; Marker and Mehlinger, 1972; Rosenau, 1974; Sikorski et al., 1976; and others). (5,8)

Newsletters have been used by several curriculum developers to develop interest in the project's materials among users and to keep them informed about the progress of development (Sikorski et al., 1976; and others). (5,6,8)

Poor communication within schools and among schools in the same or neighboring districts may constitute important bariers to change (Zaltman et al., 1977; and others) (1,2,3,4,8)

The adoption of curriculum materials at the state level affects curriculum change efforts (EPIE, 1976; Sikorski et al., 1976; and others). (5,6,9)

With or without state adoption, all states have laws that influence curriculum change efforts (Duet et al., 1976; Brown and Brown, 1969; NACOME, 1975; Sikorski et al., 1976; and others). (5,6,9)

The role of the states in shaping school policy has accelerated in the last 20 years (Milstein, 1976; Fuller and Pearson, 1969; Wirt, 1977; Helgeson et al., 1977; and others). (9)

The influence of state governments on science education has increased since 1955 (Helgeson et al. 1977; and others). (9)

Federal policies have stimulated the adoption of innovations. However, they have not strongly affected those factors that really matter in promoting effective implementation, teacher change, and project continuation (Berman et al., 1977). (4,5,7,9)

Since state financial support has tended to follow federal trends, state support for science education has declined and is likely to continue to do so (Helgeson et al., 1977; and others). (9)

Inflation and reduced enrollments have required many districts to take actions based on the local financial situation. (Helgeson et al., 1977; and others). (9)

State control of education is exerted in many areas.

Some examples of these areas are school organization, school curriculum, teacher certification and financial support for the schools. Science education has been impacted both negatively and positively by state influences (Helgeson et al., 1977; Lawyers' Committee for Civil Rights, 1973; Wirt, 1977; and others). (1,2,4,5,9)

Some federal laws affect the needs or resources of districts, while others directly affect curriculum development and dissemination (Daveney and Thorn, 1974; Beckum et al., 1975; Fullan and Pomfret, 1975; Grobman, 1969; Sikorski et al., 1976; and others). (1,5,8,9)

A longitudinal perspective is needed in change strategy evaluation (Sikorski et al., 1978; Gross et al., 1971; Smith and Keith,1971; Charters et al., 1973; Bentzen, 1974; Berman and Mclaughlin, 1975; Jones, 1973; Wacaster, 1973; Pressman and Wildavsky, 1973; Mann, 1976; Greenwood et al., 1975; Hall et al., 1975; Fullan and Pomfret, 1975; Kester, 1976; Bentzen, 1974; House, 1975; and others). (5,7)

The change/innovation process is enhanced by the establishment of viable links between the organization and resources within its environment (Zaltman et al., 1977; and others). (1,2,3,4,6)

Summary

The literature reviewed indicates substantial activity and some change related to the secondary school science curriculum between the early 1960s and the early 1970s. Beginning with the early 1970s the amount of curriculum development activity decreased. Data from previous studies indicate the use of the laboratory, hands-on activity and inservice education also decreased. Federal, state and local financial support appeared to be diverted from science education programs to other areas. A substantial decline in total school enrollment was indicated. In addition, most state departments of education expanded both in size and in function; data reported indicate departments of education became more involved in a variety of local school regulations and decisions.

No studies were identified that studied specific schools for a period of time. This study provides data on the status of science teaching in 1979/80 and compares the status with previous practices to identify specific changes that have occurred in these schools and to relate these changes to other variables. The status and change data are also compared to previous studies to compare this sample of schools to other samples.

Between the early 1960s and the late 1970s research on implementation of school programs and on the change process gained more attention. Research summarized in this chapter identifies many variables that have been found to be related to successful programs and successful change. These variables include the principal, the attitude of the principal, the teaching staff, the attitude of the teaching staff, and program support.

Data were obtained in this study to relate to the current status of science teaching and to changes in programs to determine whether variables suggested by the literature related to these schools. This study should provide further information regarding the impact of these variables on science education practices and programs.

Finally, very few studies were found where ideas regarding desired or needed changes were identified and later investigated to determine the relationship of perceived needs by teachers and principals to change or lack of change, Many studies related to change asked questions post hoc and frequently could not relate change or lack of change to actual conditions and changes in these conditions, Data obtained in this study will enable other investigators to compare the status of programs, attitudes of principals and teachers, and other variables in 1979/80 to change or lack of change that occur in these schools in the future.

This study, therefore, should (1) contribute to knowledge about the status of science programs in these sample schools, (2) identify variables that have changed and have not changed in the science programs and other variables of these schools in the past 10 years, (3) identify variables related to status and change or lack of change in the sample schools, and (4) obtain information that can be used by other investigators to study instruction and curriculum practices in these schools on a longitudinal basis.

CHAPTER III

DESIGN OF THE STUDY

This chapter contains a description of the following elements of this study: (1) population and sampling; (2) development instruments; (3) variables investigated; (4) procedures of data collection; (5) data verification, validity and reliability of instruments and reliability of data; (6) follow-up procedures and response rate; and (7) analysis of data.

Population of Sample

The 1970-71 Study:

The population of the original 1970-71 OSU study consisted of all public secondary schools in the United States that were listed in the state education directories for the 1969-70 school year. The number of secondary schools sampled was 6,398, or approximately 25 percent of the schools listed in the state directories.

The states were grouped into eight regions for comparative purposes. These regions were New England, Mideast, Great Lakes, Southeast, Plains, Rocky Mountains, Southwest and Farwest.

Figure 3.1 represents the geographic distribution of the public secondary schools for the 1970-71 survey. States selected for 1979-80 are underlined. The states included in each of the regions were as follows:

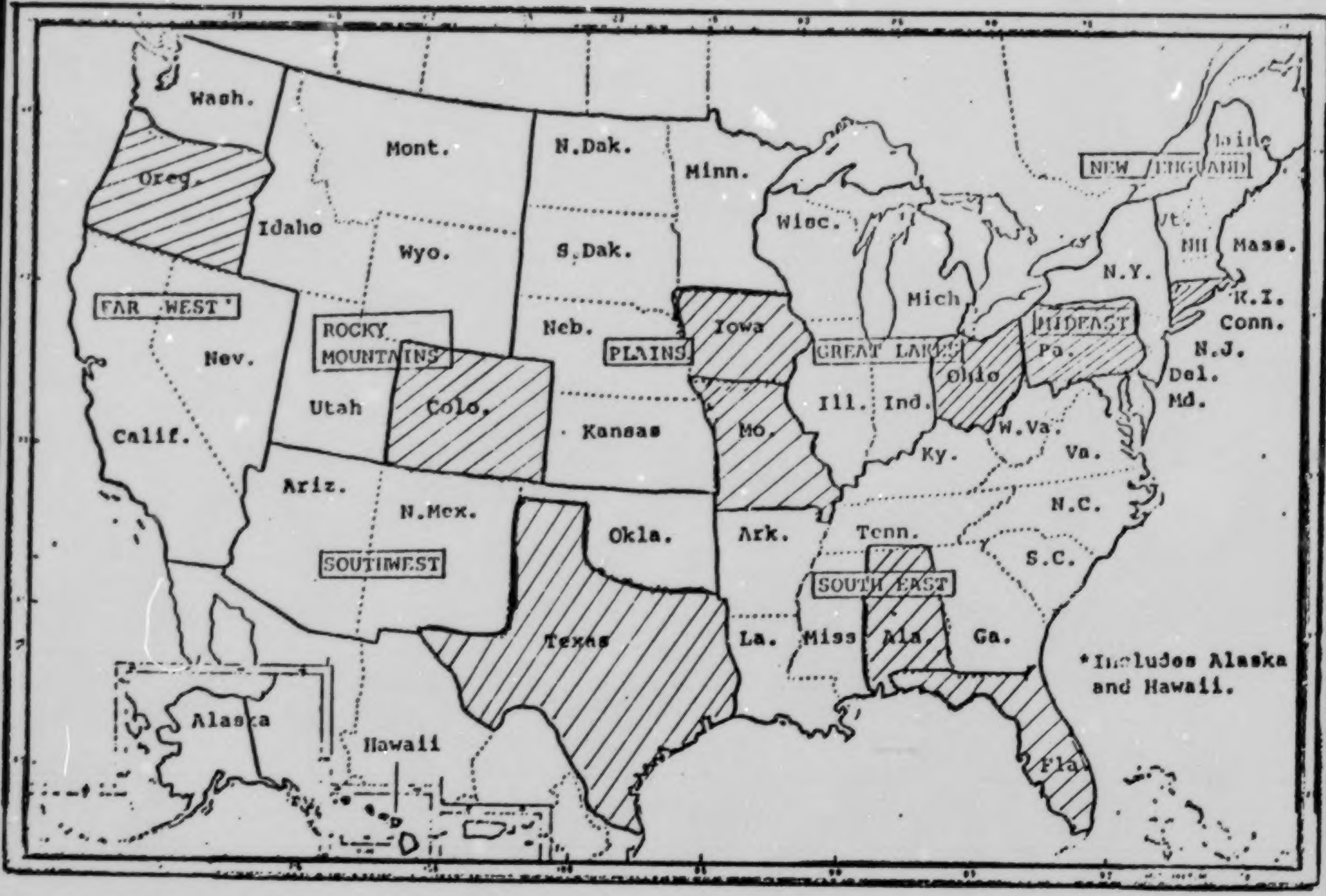
Wash.
Oreg.
Idaho
Mont.
N.Dak.
Minn.
Wyo.
S.Dak.
Wisc.
Mich
N.Y.
Maine
NEW ENGLAND
Vt.
NH
Mass.
R.I.
Conn.
FAR WEST*
ROCKY MOUNTAINS
Neb.
PLAINS
Iowa
GREAT LAKES
MIDEAST
Nev.
Pa.
N.J.
Ohio
Del.
Md.
Utah
Colo.
Ill.
Ind.
Calif.
Kansas
Mo.
W.Va.
Ky.
Va.
Ariz.
N.Mex.
N.C.
Okla.
Ark.
Tenn.
SOUTHWEST
S.C.
SOUTH EAST
Texas
La.
Miss
Ala.
Ga.
*Includes Alaska and Hawaii.
Alaska
Hawaii
Fla.

FIGURE 3.1

THE GEOGRAPHIC DISTRIBUTION OF THE PUBLIC SECONDARY SCHOOLS FOR THE 1970/71 SURVEY

Great Lakes:	Illinois, Indiana, Michigan, Ohio, Wisconsin.
Farwest:	Alaska, California, Hawaii, Nevada, Oregon, Washington.
New England:	Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont.
Mideast:	Delaware, District of Columbia, Maryland, New Jersey, New York, Pennsylvania.
Southwest:	Arizona, New Mexico, Oklahoma, Texas.
Rocky Mountains:	Colorado, Idaho, Montana, Utah, Wyoming.
Plains:	Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota.
Southeast:	Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, West Virginia, Virginia.

The 1979-80 Study Sample

The target population of 1979-80 consisted of public secondary schools (grades 7-12) which participated in the 1970-71 OSU study and in which both the principal and the teacher(s) responded. The sample of 1979-80 was selected in the three following stages:

(1) The Selection of States:

The selection of a sample of states was based on a balance of two criteria: (a) region; and (b) state control of education (high, middle and low). The states were grouped into eight regions in the 1970-71 OSU study. State control of education was based on Wirt's School Centralization Score (SCS) scale (see Appendix A). Eight states were selected to provide representation of regions and distribution of high, middle and low state control scores. These states were: Ohio, Oregon, Connecticut, Pennsylvania, Texas, Colorado, Iowa and Alabama. In addition to the eight states, two other states were selected for two reasons: (1) The Plains and Southeast regions were relatively large regions; (2) The procedure would increase the number of states that ranked high or low on the Wirt Scale. Thus, one more state that ranked high and another state that ranked low on the Wirt Scale were selected from the Plains and Southeast regions. The selected states were Missouri and Florida. The selected states in each of the eight regions were as follows:

Great Lakes: Ohio
Farwest: Oregon
New England: Connecticut
Mideast: Pennsylvania
Southwest: Texas
Rocky Mountains: Colorado
Plains: Iowa and Missouri
Southeast: Alabama and Florida

Figure 3.2 shows that Oregon, Alabama and Florida were the states of high control of education; Connecticut, Texas and Missouri were the states of low control of education; and Ohio, Pennsylvania, Colorado and Iowa were the states of average control of education.

(2) Random Selection of Secondary Schools

A computer run of the computer tapes, the sampling frame of 1970-71 OSU study, was done to identify the secondary schools (grades 7-12) of the selected states in which both

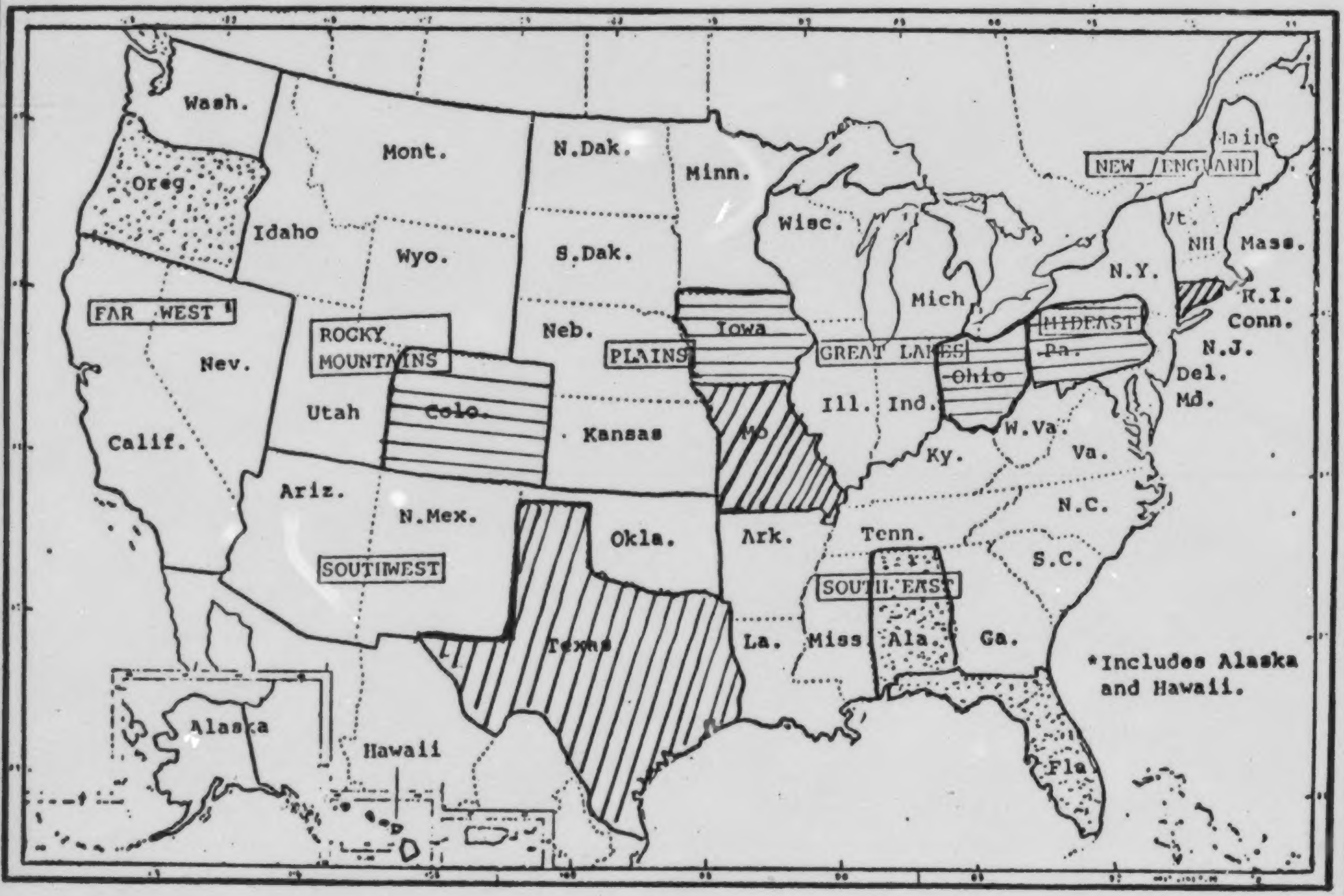
Wash.
Oreg.
Idaho
Mont.
Wyo.
N.Dak.
S.Dak.
Minn.
Wisc.
Mich
NEW ENGLAND
Maine
Vt.
NH
Mass.
N.Y.
R.I.
Conn.
N.J.
Del.
Md.
FAR WEST*
Nev.
Calif.
ROCKY MOUNTAINS
Utah
Colo.
Neb.
PLAINS
Iowa
Kansas
Mo
GREAT LAKES
Ill.
Ind.
Ohio
MIDEAST
Pa.
W.Va.
Va.
Ky.
Ariz.
N.Mex.
SOUTHWEST
Okla.
Texas
Ark.
Tenn.
N.C.
S.C.
SOUTHEAST
La.
Miss
Ala.
Ga.
Fla
Alaska
Hawaii
*Includes Alaska and Hawaii.

FIGURE 3.2
STATE GROUPINGS (STATE CONTROL OF EDUCATION) USED IN THE STUDY

░	STATES OF HIGH CONTROL OF EDUCATION	▤	STATES OF AVERAGE CONTROL OF EDUCATION	▨	STATES OF LOW CONTROL OF EDUCATION

the principal and the teacher(s) participated. Ten schools were selected randomly from each state from the secondary schools listed in the state education directories for the 1978-79 school year. The total number of the sampled schools was 100 secondary schools which represented 16 percent of the final sample of schools in 1970-71. The selection of these sampled schools was delimited to three types of schools (grades 7-9, grades 10-12, and grades 9-12), and to schools with enrollments of more than 300 students (Table 3.1) Principals of each of the sampled schools were requested to participate in this study.

(3) Random Selection of Secondary Science Teachers within the Selected Schools

Three science teachers were randomly selected by the building principal within each sampled school. The principal of a selected school received directions for randomly selecting three science teachers on his teaching staff to participate in the study.

Sample Size

The sample of this study consisted of 100 secondary schools, 10 schools for each state, which participated in the OSU 1970-71 study. Four of these selected schools, two in Ohio and two in Oregon had only one building in the 1970-71 school year. It was found that each of these four schools had two buildings in the 1979-80 school year. Consequently, the number of the buildings of each of the

TABLE 3.1

SELECTED SECONDARY SCHOOLS BY STATE

Number	State	Region	Number of participating schools (1970/71)	Number of sampled schools (1979/80)	Types of secondary schools			SCS (Wirt)
					(9-12)	(10-12)	(7-9)	
1	Ohio	Great Lakes	99	10	6	4	0	3.65
2	Oregon	Far West	30	10	7	1	2	4.30
3	Connecticut	New England	26	10	7	3	-	2.68
4	Pennsylvania	Mid-East	144	10	2	4	4	3.75
5	Texas	Southwest	111	10	4	3	3	2.88
6	Colorado	Rocky Mountains	31	10	1	3	6	3.79
7	Iowa	Plains	45	10	2	5	3	3.80
8	Missouri	Plains	46	10	2	7	1	2.84
9	Alabama	Southeast	22	10	8	0	1	4.67
10	Florida	Southeast	83	10	4	1	5	4.19
		Total	637	100	43	31	25	

two states, Ohio and Oregon, had a principal for each building; while the other two buildings in the two states had one principal for the two buildings. Thus, the total number of the principals participating in this study was 102.

With respect to the science teachers three teachers were selected for each building. Thus, 36 teachers were selected for each of Ohio and Oregon. It was also found that one of the selected schools in Texas, Alabama and Florida had only two science teachers, while two of the selected schools in Iowa had only two science teachers. Thus, 29 science teachers were selected for each of Texas, Alabama and Florida; and 28 teachers for Iowa. The total number of the selected science teachers in the sample was 307 science teachers (Table 3.2).

Verification of the Existence of the Sample Schools and the Names of the Administrative Staff

Existence of the sample schools was verified by using the 1978-79 state educational directories. Some state departments of education and some schools were called to verify other data including the number of buildings of some schools, names of the principals of 1979-80 and student enrollments. The sample schools' identification data were recorded on special forms (See Appendix A).

Summary of Sampling Procedures

The procedures followed in the selection of the

TABLE 3.2

NUMBER OF THE SAMPLED SECONDARY SCHOOLS, BUILDINGS, PRINCIPALS AND TEACHERS BY STATE

State	Sample size							
	Schools		Buildings		Principals		Teachers	
	Number of schools	Percent of total schools	Number of buildings	Percent of total buildings	Number of principals	Percent of principals	Number of teachers	Percent of teachers
Ohio	10	10.0	12	11.6	11	10.8	36	11.7
Oregon	10	10.0	12	11.6	11	10.8	36	11.7
Connecticut	10	10.0	10	9.6	10	9.8	30	9.8
Pennsylvania	10	10.0	10	9.6	10	9.8	30	9.8
Texas	10	10.0	10	9.6	10	9.8	29	9.4
Colorado	10	10.0	10	9.6	10	9.8	30	9.8
Iowa	10	10.0	10	9.6	10	9.8	28	9.1
Missouri	10	10.0	10	9.6	10	9.8	30	9.8
Alabama	10	10.0	10	9.6	10	9.8	29	9.4
Florida	10	10.0	10	9.6	10	9.8	29	9.5
Total	100	100.0	104	100.0	102	100.0	307	100.0

1979-80 sample is presented in Figure 3.3.

Development of Instruments

The development of the questionnaire for this study involved the review of:

1. Literature related to previous survey studies in science education.
2. National, regional and state studies related to science teaching practices and characteristics.
3. Literature related to innovation in science education and to change in science practices and curricula.
4. Literature related to attitudes of teachers and principals toward the change in science curricula and school practices.
5. Survey research techniques and questionnaire construction. Particular attention was paid to questionnaire design, use and format.

The OSU study of 1970-71; Weiss study of 1978; Stake study of 1978; and Helgeson, Blosser and Howe study of 1977 were used very heavily as sources for construction of questionnaire items. A preliminary set of research questions and data resources was developed and questionnaire items which could be used to answer these research questions were written (or, in some cases, items appearing in the OSU study of 1970-71 were revised) and preliminary drafts of the questionnaires were prepared.

Instrument development, including item construction, review and

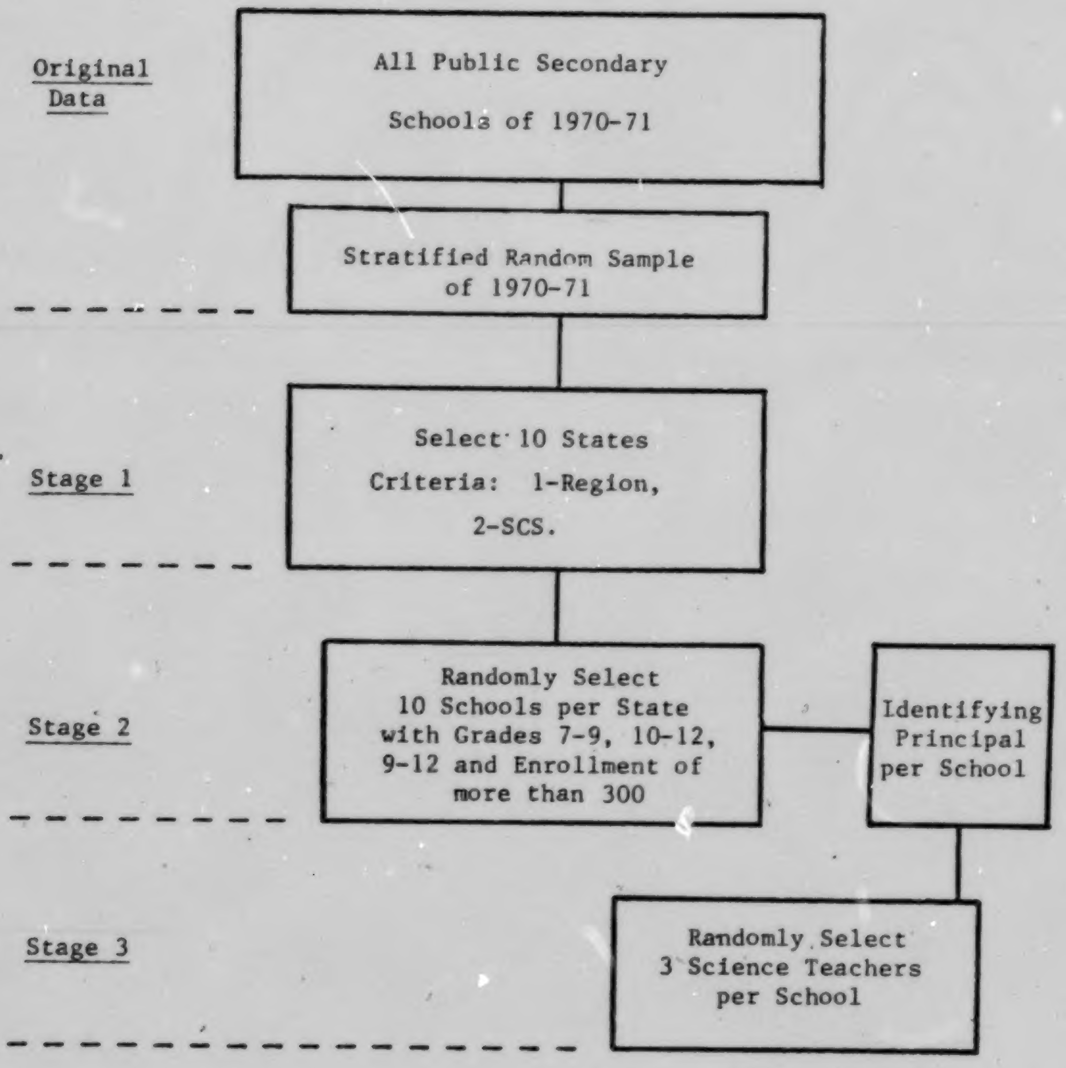
Original Data
All Public Secondary Schools of 1970-71
Stratified Random Sample of 1970-71
Stage 1
Select 10 States Criteria: 1-Region, 2-SCS.
Stage 2
Randomly Select 10 Schools per State with Grades 7-9, 10-12, 9-12 and Enrollment of more than 300
Identifying Principal per School
Stage 3
Randomly Select 3 Science Teachers per School

FIGURE 3.3

SAMPLING DESIGN

revision began in March, 1977, and continued until September, 1979. The preliminary drafts of the questionnaires were reviewed by the investigator's advisers. The questionnaires were examined by science education faculty members and doctorial candidates as well as science supervisors, administrators and science teachers to determine their potential use and value for this study. They were also piloted in 1977 in 12 secondary schools in Ohio, Pennsylvania and Michigan. Modification was done as a result of all feedback. Particular attention was given to the design of each questionnaire. The final versions of the various questionnaires were reviewed by the investigator's advisers and approval was granted to use these instruments in September, 1979.

The Human Subjects Review Committee (HSRC) at The Ohio State University (OSU) was contacted for approval to undertake the study. A sample of materials and letters, in addition to a summary sheet of the study and a request for waiver of written consent for the study were submitted to the HSRC. Approval was granted to conduct the study.

Instruments

The instruments used for the study are listed and described below:

Status of Science Teaching in Public Secondary Schools in in 1979-80 school year: (Q: SP): Principal Questionnaire

The (Q:SP) instrument was designed to be completed and returned by each selected school's principal. It was constructed to obtain data related to school organization, principal's experience, teaching staff, science budget, science course offerings, and major changes in school science program which had been made since 1971. The development of the (Q:SP) depended heavily on the principal's questionnaire of the OSU study of 1971. Some of the items were quite similar, others were modified. The information requested on this instrument was to be summative in nature with respect to all science classes and science programs in the selected schools. The total number of variables for the (Q:SP) was 502 variables. (See Appendix B)

Status of Science Teaching in Public Secondary Schools in 1979-80 school year: (Q:ST). Science Teacher Questionnaire. The (Q:ST) instrument was designed to be completed and returned by three science teachers who were selected by the principal of each of the schools. Items were included to gather data about secondary school science teacher characteristics, teaching load, special science facilities, science teaching practices, science courses and textbooks, learning activities, major changes in school science program which had been made since 1971, and teacher satisfaction with teaching science. In general, this instrument was constructed to collect information about specific characteristics of teachers who were teaching secondary school science as well as the conditions under which science instruction was taking place and the approaches used during instruction. The development of the (Q:ST) depended heavily, as did the (Q:SP), on the 1971 OSU questionnaire (teacher's questionnaire). Some of the items were quite similar, others were modified. The total number of the variables for (Q:ST) was 527 variables. (See Appendix B)

Attitude Instruments

1. Attitudes toward Change in Science Education: (Q:AP). Principal Questionnaire
2. Attitudes toward Change in Science Education: (Q:AT). Science Teacher Questionnaire

The (Q:AP) and (Q:AT) were developed for this study. The (Q:AP) and (Q:AT) are quite similar and were designed to be completed and returned by each principal and each of the three science teachers who were selected from each of the schools. Items were included to identify the attitudes of the principals or the teachers toward: (1) decision making in determining the science curriculum; (2) changes in science curriculum and instruction; (3) resources of information about new practices and materials in science education; (5) barriers to change; and (6) incentives to change. In general, the (Q:AP) and (Q:AT) were constructed to identify science teachers' and principals' attitudes toward change in science curricula and school practices. The (Q:AP) had a total of 198 variables, while the (Q:AT) had a total of 199 variables. (See Appendix B)

Perception Instruments:

1. Checklist for Assessment of Science Teacher (CAST:PP). Principal's Perception

2. Checklist for Assessment of Science Teacher (CAST:TP). Teacher's Perception

The Checklist for Assessment of Science Teacher (CAST) was designed to be used to measure principals' and teachers' perceptions of what usually takes place or should take place in the science classrooms.

The Checklist for Assessment of Science Teacher (CAST) was adopted from the work of Robert W. Howe; William R. and Betty J. Brown (1972) at The Ohio State University. Five dimensions out of 15 were selected to be used from this study. These dimensions are: (1) student's role in class; (2) teacher's role in class; (3) use of textbooks and reference materials; (4) design and use of tests; and (5) conducting the science laboratory. (See pages 108, 109 and 110 for validity and reliability data.)

A cover page was prepared for each of CAST:PP and CAST:TP including the purpose of the checklist and providing the principals and the teachers with directions of how to use the checklist. In addition, an answer sheet was developed and added at the end of this checklist. Respondents were asked to circle their responses of what was taking place and what should take place in the science classroom.

The principals and the teachers were requested to use the same checklist. The only difference between the (CAST:PP) and the (CAST:TP) was in the directions given for each group (See Appendix B).

The (CAST:PP) and (CAST:TP) were used in the pilot study with the other instruments to determine its potential use and value in this study.

State Science Supervisor Questionnaire

This questionnaire was developed for the purpose of this study to provide some information about the science program in the selected states. This questionnaire was not analyzed for this study (Appendix B).

Variables Investigated

A list of the variables of the instruments included in this study is presented in the Appendix (see Appendix C). The number, name, and the coding of each variable are included. In addition, the computer card and column(s) numbers for each variable are presented.

A summary of the variables by instrument is given below. The number of variables under each category is provided in parentheses.

Variable Sets of (Q:SP)

Table 3.3 presents variable sets of the Principal's Questionnaire for the Status of Science Teaching in Public Secondary Schools (Q:SP). Categories of items found to be important in the literature (see Chapter II) were selected for item development. Data show that the total number of the (Q:SP) variables was 502 variables. (See page 108 and 112 for validity and reliability data.)

Variable Sets of (Q:ST)

Table 3.4 presents variable sets of the Teacher's Questionnaire for the State of Science Teaching in Public Secondary Schools (Q:ST). Categories of items found to be important in the literature (see Chapter II) were selected for items development. Data show that the total number of the (Q:ST) variables was 527 variables. (See pages 106 and 110 for validity and reliability data.)

TABLE 3.3

VARIABLE SETS OF THE PRINCIPAL'S QUESTIONNAIRE FOR THE STUDY OF SCIENCE TEACHING IN PUBLIC SECONDARY SCHOOLS (Q:SP)

Variable set	Number of variables
School Organization	26
Principal Characteristics	4
Science Teacher Characteristics	17
Science Budget	17
Course Offerings	
Biology or Life Science	120
Chemistry	43
Physics	29
Physical Science	36
Earth Science	36
Other Courses or Textbooks	36
General Science	8
Specialized Science Courses	82
Environmental Education	32
Science Courses for Exceptional Students	4
Changes in Science Teaching	12
Total number of variables	502

TABLE 3.4

VARIABLE SETS OF THE TEACHER'S QUESTIONNAIRE FOR THE STATUS OF SCIENCE TEACHING IN PUBLIC SECONDARY SCHOOLS (Q:ST)

Variable set	Number of variables
Teacher Characteristics	23
Teaching Load	21
Special Science Facilities	33
Science Teaching Materials	7
Course Offerings	
Biology or Life Science	120
Chemistry	43
Physics	29
Physical Science	36
Earth Science	36
Other Courses or Textbooks	38
General Science	8
Specialized Science Courses	82
Science Courses for Exceptional Students	4
Assistance Needed	14
Inservice Training	6
Learning Activities	16
Changes in Science Teaching	13
Total number of the (Q:ST) Variables	527

Variable Sets of (Q:AP)

Table 3.5 presents variable sets of the Principal's Attitude Questionnaire (Q:AP). Categories of items found to be important in the literature (see Chapter II) were selected for item development. Data show that the total number of the (Q:AP) variables was 198 variables. (See pages 108, 110 and 113 for validity and reliability data.)

TABLE 3.5

VARIABLE SETS OF THE PRINCIPAL'S ATTITUDE QUESTIONNAIRE (Q:AP)

Variable set	Number of variables
Decision Making with Respect to Science Curricula	22
Value of Change in Science Curriculum and Instruction	11
Resources of Information about Science Materials and Practices	86
Federal Support for Curriculum Development	10
Objectives of Science Education	12
Barriers to Change	57
Total number of variables	198

Variable Sets of (Q:AT)

Table 3.6 presents variable sets of the Teacher's Attitude Questionnaire (Q:AT). Categories of items found to be important in the literature (see Chapter II) were selected for item development. Data show that the total number of the (Q:AT) variable was 199 variables. (See pages 106, 108 and 111 for validity and reliability data.)

TABLE 3.6

VARIABLE SETS OF THE TEACHER'S ATTITUDE QUESTIONNAIRE (Q:AT)

Variable set	Number of variables
Decision Making with Respect to Science Curriculum	22
Value of Change in Science Curriculum and Instruction	11
Resources of Information about Science Materials and Practices	87
Federal Support for Curriculum Development	10
Objectives of Science Education	12
Barriers to Change	57
Total number of variables	199

Variable Sets of (CAST:PP) and (CAST:TP)

Tables 3.7 and 3.8 present variable sets of the checklist for Assessment of Science Teacher (CAST:PP) and (CAST:TP). Data show that the total number of each of CAST:PP and CAST:TP was 10 variables.

TABLE 3.7

VARIABLE SETS OF THE CHECKLIST FOR ASSESSMENT OF SCIENCE TEACHER'S PERCEPTION (CAST:PP)

Variable set	Number of variables
Student Activities	2
Science Teacher's Role	2
Use of Textbook and Reference Materials	2
Design and Use of Tests	2
Laboratory Activities	2
Total number of variables	10

TABLE 3.8

VARIABLE SETS OF THE CHECKLIST FOR ASSESSMENT OF SCIENCE TEACHER. TEACHER'S PERCEPTION (CAST:TP)

Variable set	Number of variables
Student Activities	2
Science Teacher's Role	2
Use of Textbook and Reference Materials	2
Design and Use of Texts	2
Laboratory Activities	2
Total number of variables	10

Variables of the Change in Science Curricula and School Practices from 1970-71 and 1979-80

The principals' survey questionnaires of 1970-71 and 1979-80 were used to identify the changes that occurred in science curricula and school practices in the selected schools from 1970-71 to 1979-80. Common variables in the two questionnaires were identified. It was found that 75 variables were used in both of the two principals' survey questionnaires of 1970-71 and 1979-80. Those common variables were grouped into six categories. Table 3.9 presents these six variable sets.

TABLE 3.9

VARIABLES SETS OF THE COMMON VARIABLES IN BOTH THE TWO PRINCIPALS' SURVEY QUESTIONNAIRES OF 1970-71 AND 1979-80

Variable set	Number of variables
(1) School Organization	4
(2) Student Enrollment	7
(3) Science Teachers	8
(4) Science Budget	5
(5) Course Offerings	20
(6) Environmental Education	31
Total number of variables	75

The names, abbreviations and coding for these 75 common variables in both of the 1970-71 and 1979-80 principals' questionnaires are presented in Table 3.10.

TABLE 3.10

NAMES, ABBREVIATIONS AND CODING FOR THE COMMON VARIABLES IN BOTH OF THE 1970-71 AND 1979-80 PRINCIPALS' SURVEY QUESTIONNAIRES

No.	Abbreviation	Name	Code
I.	SCHOOL ORGANIZATION:		
1	Type JR	Grade 7-9	1 = yes, 0 = no
2	Type HS	Grade 9-12	1 = yes, 0 = no
3	Type SHS	Grade 10-12	1 = yes, 0 = no
4	Sc Type	Type of School	Grade 7-9 Grade 9-12 Grade 10-12
II.	ENROLLMENT:		
5	Roll G7	Enrollment for Grade 7	Number
6	Roll G8	Enrollment for Grade 8	Number
7	Roll G9	Enrollment for Grade 9	Number
8	Roll G10	Enrollment for Grade 10	Number
9	Roll G11	Enrollment for Grade 11	Number
10	Roll G12	Enrollment for Grade 12	Number
11	Tot Roll	Total	Number
III.	SCIENCE TEACHERS:		
12	Teach Sci M	Number of male Sc teachers	Number
13	Teach Sci F	Number of female Sc teachers	Number
14	Teach Sci T	Total Number of Sc teachers	Number
15	Teach Sci T_1	Total Number of Science Teachers with 0-20% Assignment	Number
16	Teach Sci T_2	Total Number of Sci Teachers with 21-40% Assignment	Number
17	Teach Sci T_3	Total Number of Sci Teachers with 41-60% Assignment	Number
18	Teach Sci T_4	Total Number of Sci Teachers with 61-80% Assignment	Number
19	Teach Sci T_5	Total Number of Sci Teachers with 81-100% Assignment	Number
IV.	SCIENCE BUDGET:		
20	Sci Eq	Science Equipment Budget	1 = yes, 0 = no
21	Eq Budg	Equipment Budget per Student	Number
22	Sci Sup	Science Supplies Budget	1 = yes, 0 = no
23	Sup Budg	Supplies Budget per Student	Number
24	Teach Pur Eq	Teacher Purchase of Sci Equipment and Supplies	1 = yes, 0 = no
V.	COURSE OFFERINGS:		
25	Gs	General Science	1 = yes, 0 = no
26	Biol/Lif Sc	Biology or Life Science	1 = yes, 0 = no
27	Chem	Chemistry	1 = yes, 0 = no
28	Phys	Physics	1 = yes, 0 = no
29	Earth Sc	Earth Science	1 = yes, 0 = no
30	Geology	Geology	1 = yes, 0 = no
31	Physical Sc	Physical Science	1 = yes, 0 = no
32	IPS	Use of IPS	1 = yes, 0 = no
33	ISCS	Use of ISCS	1 = yes, 0 = no
34	ESCP	Use of ESCP	1 = yes, 0 = no
35	BSCS B	Use of BSCS Blue	1 = yes, 0 = no
36	BSCS G	Use of BSCS Green	1 = yes, 0 = no
37	BSCS Y	Use of BSCS Yellow	1 = yes, 0 = no
38	CHEMS	Use of CHEMS	1 = yes, 0 = no
39	PSSC	Use of PSSC	1 = yes, 0 = no
40	PP	Use of PP	1 = yes, 0 = no
41	Honor	Offering an Honors Science Program	1 = yes, 0 = no
42	Adv Biol	Offering an Advanced Biology Course (Second Year)	1 = yes, 0 = no
43	Adv Chem	Offering an Advanced Chemistry Course (Second Year)	1 = yes, 0 = no
44	Adv Phys	Offering an Advanced Physics Course (Second Year)	1 = yes, 0 = no

TABLE 3.10 (CONTINUED)

No.	Abbreviation	Name	Code
VI.	ENVIRONMENTAL EDUCATION:		
45	EE	Teaching Environmental Education in School	1 = yes, 0 = no
46	EE	Teaching Environmental Ed Separately in Grade 7	1 = yes, 0 = no
47	EE G8	Teaching Environmental Ed Separately in Grade 8	1 = yes, 0 = no
48	EE G9	Teaching Environmental Ed Separately in Grade 9	1 = yes, 0 = no
49	EE G10	Teaching Environmental Ed Separately in Grade 10	1 = yes, 0 = no
50	EE G11	Teaching Environmental Ed Separately in Grade 11	1 = yes, 0 = no
51	EE G12	Teaching Environmental Ed Separately in Grade 12	1 = yes, 0 = no
52	EE W Sc G7	Teaching Environmental Ed with Science in Grade 7	1 = yes, 0 = no
53	EE W Sc G8	Teaching Environmental Ed with Science in Grade 8	1 = yes, 0 = no
54	EE W Sc G9	Teaching Environmental Ed with Science in Grade 9	1 = yes, 0 = no
55	EE W Sc G10	Teaching Environmental Ed with Science in Grade 10	1 = yes, 0 = no
56	EE W Sc G11	Teaching Environmental Ed with Science in Grade 11	1 = yes, 0 = no
57	EE W Sc G12	Teaching Environmental Ed with Science in Grade 12	1 = yes, 0 = no
58	EE W So G7	Teaching Environmental Ed with Social Studies in grade 7	1 = yes, 0 = no
59	EE W So G8	Teaching Environmental Ed with Social Studies in grade 8	1 = yes, 0 = no
60	EE W So G9	Teaching Environmental Ed with Social Studies in grade 9	1 = yes, 0 = no
61	EE W So G10	Teaching Environmental Ed with Social Studies in grade 10	1 = yes, 0 = no
62	EE W So G11	Teaching Environmental Ed with Social Studies in grade 11	1 = yes, 0 = no
63	EE W So G12	Teaching Environmental Ed with Social Studies in grade 12	1 = yes, 0 = no
64	EE 2S G7	Teaching Environmental Ed integrated with 2 or more subjects including science in grade 7	1 = yes, 0 = no
65	EE 2S G8	Teaching Environmental Ed integrated with 2 or more subjects including science in grade 8	1 = yes, 0 = no
66	EE 2S G9	Teaching Environmental Ed integrated with 2 or more subjects including science in grade 9	1 = yes, 0 = no
67	EE 2S G10	Teaching Environmental Ed integrated with 2 or more subjects including science in grade 10	1 = yes, 0 = no
68	EE 2S G11	Teaching Environmental Ed integrated with 2 or more subjects including science in grade 11	1 = yes, 0 = no
69	EE 2S G12	Teaching Environmental Ed integrated with 2 or more subjects including science in grade 12	1 = yes, 0 = no
70	EE 2NS G7	Teaching Environmental Ed integrated with 2 or more subjects not including science in grade 7	1 = yes, 0 = no
71	EE 2NS G8	Teaching Environmental Ed integrated with 2 or more subjects not including science in grade 8	1 = yes, 0 = no
72	EE 2NS G9	Teaching Environmental Ed integrated with 2 or more subjects not including science in grade 9	1 = yes, 0 = no
73	EE 2NS G10	Teaching Environmental Ed integrated with 2 or more subjects not including science in grade 10	1 = yes, 0 = no
74	EE 2NS G11	Teaching Environmental Ed integrated with 2 or more subjects not including science in grade 11	1 = yes, 0 = no
75	EE 2NS G12	Teaching Environmental Ed integrated with 2 or more subjects not including science in grade 12	1 = yes, 0 = no

Procedures of Data Collection

Approach to the Schools

Since confidence in the results of the study would be enhanced by a high response rate from sample schools, every effort was made to employ procedures and techniques that would encourage cooperation. Some of the factors that are believed to contribute to the high level of cooperation are considered under the following headings.

Timing

The time at which schools would be approached during the school year was important. To make sure that the time was appropriate for administering instruments, state science supervisors were informed about the time schedule and the majority suggested that the best time for collecting data was fall 1979. They considered this time of the school year appropriate for teachers and principals to give their responses on the questionnaires. Thus, a decision was made to administer the instruments during November and December 1979.

The cooperation of State Science Supervisors (Consultants).

It was decided that the most effective method for collecting data would be to mail the materials to sample schools through the state science supervisors (consultants). In April and May,1979, initial phone calls with each of the state science supervisors of the ten states were made to determine the feasibility of conducting the proposed research. The responses were positive and nine of the ten science supervisors gave approval to conduct the study in the sampled schools, and to send the materials to schools through them.

For the state in which the science consultant did not agree to send the materials through him, the state director of curriculum implementation was contacted by phone. An approval was requested of him to send the materials directly to the principals of the selected schools in the state and to let each principal to take decision for his or her willingness to participate in the study. A follow-up phone call was made to each of the nine state science supervisors and to the director of curriculum implementation of the tenth state during the last two weeks of August, 1979, to confirm conducting the study and to get some information about the sampled schools.

A letter of gratitude and a detailed plan for the study were sent to each science supervisor of the nine states, and to the director of the curriculum implementation of the tenth state on October 15, 1979. A form was also enclosed for each science supervisor to be signed giving approval for participating in the study and for being involved in sending the materials to the selected schools in their states (See Appendix D). It was decided not to send any material for any state before having this form signed and completed by the science supervisor confirming his or her approval of participation in the study.

Packages of Materials

Nine packages of materials were prepared for the state science supervisors of the selected states. Each package consisted of 11 packets. One packet was addressed personally to the state science supervisor and each of the other ten was addressed personally to one of the principals of the sample school.

Each packet sent to the state science supervisors contained the following items:

(1) cover letter addressed to the state science supervisor emphasizing the importance of his/her cooperation and participating in the study; (2) a description of the study; (3) the state science supervisor questionnaire; (4) a set of teachers' and principals' questionnaires (Appendix D); and (5) copies of reports from the OSU secondary schools survey study of 1970-71.

Each packet sent to the principals contained the following items:

(1) cover letter addressed to the principal requesting participation in the study and emphasizing the importance of his/her cooperation for the success of the study; (2) a description of this study; (3) principals' instruments; (4) procedures for randomly selecting three science teachers; (5) three packets, each containing a covering letter, three instruments, and a description of the study for each of the selected science teachers (Appendix D); and (6) a copy of the report of the OSU secondary school survey study of 1970-71.

The principals were requested to randomly select three science teachers and give each selected teacher a set of questionnaires. The principals and the teachers were also requested to return all the completed questionnaires directly to the investigator. Stamped addressed envelopes for the return of the questionnaires were sent within each packet.

Mailing of Materials

By November 15, 1979, seven science supervisors sent their written approval to the investigator (Appendix D). Packages of materials were mailed to these seven science supervisors on November 20, 1979. Each state science supervisor was requested to mail the materials packets to the schools by December 8, 1979. The principals and the teachers were requested to return all the completed questionnaires to the investigator before January 20, 1980.

With respect to the other two states, the science supervisors were contacted by phone and they reported that the instruments and the materials had to be examined and reviewed by some specialists in the state department of education before giving the final approval to conduct the study in their states. This took some time and the final approval was sent to the investigator from one state on December 19, 1979. Materials were mailed to the science supervisor of this state on December 20, 1979. The science supervisor of this state was asked to mail the packets of materials to the selected schools by January 11, 1980. The principals and the teachers of the selected schools in this state were requested to return all the completed questionnaire to the investigator by February 11, 1980.

Regarding the second state,approval to conduct the study was sent to the investigator on January 22, 1980. Materials were mailed to the science supervisor of this state on January 24, 1980. The science supervisor of this state was asked to mail the packets of materials to the selected schools by February 7, 1980. The principals and the teachers of the selected schools in this state were requested to return all the completed questionnaires to the investigator by March 7, 1980.

With respect to the tenth state, for which the director of the curriculum implementation was contacted by phone, a package of materials similar to that sent to each state science supervisor was sent to him on November 15, 1979, to be examined and reviewed by the state department of education. The process of reviewing the materials took some time. On January 9, 1980, an approval to conduct the study in this state was given by phone on condition that the selected schools had to be contacted directly and that the principals of these selected schools should be informed that participation in this study was voluntary. Thus, a packet of materials were sent to each principal of the sample schools in this state as a sample on January 11, 1980. Each packet contained: (1) a cover letter to the principal; (2) a description of the study; (3) a set of the principals' instruments (three questionnaires); (4) a set of the teachers' instruments (a letter and a description of the study were attached to each set of instruments for each teacher); (5) procedures for selecting three science teachers; and (6) a copy of the report of OSU survey study of 1971. (See Appendix D.) A form was also enclosed to be completed by the principal about his/her willingness to participate in the study. Each principal was requested to return this form completed in a self-addressed, stampled envelope by January 25, 1980.

The principals were contacted by phone during that time to inform them about the study. Eight of these ten selected schools sent their approval to participate in the study by the end of

January, 1980. Consequently, packets of materials similar to those sent to other schools were sent to these eight schools on February 4, 1980. Principals and teachers were requested to return the completed questionnaires by March 4, 1980. Two other schools from the same primary sampling unit were randomly selected to replace those two schools that did not respond. The same procedures were followed by sending a sample of materials on February 4, 1980. This was followed by phone calls to inform the principals about the study. An approval of participation was sent by these two schools on February 14, 1980. This was followed by sending packets of materials to the two principals on February 15, 1980. Principals and teachers were requested to return all completed questionnaires in the self-stamped envelopes by March 18, 1980.

Data Verification, and Validity and Reliability of Instruments

Visits to Schools:

Arrangements were made by the investigator to visit six of the ten selected schools in Ohio during May, 1980. The purpose of these visits was to verify (validate) the data being collected; and to discuss with the principal and one of the science teachers who participated in the study any special conditions for teaching science in their school. Verification of the responses were decided by choosing representative items from the principals' and the teachers' questionnaires.

A set of items were selected from each principal's and teacher's instrument. These items were put together in one form to be completed by the selected principals and teachers. It was planned to have a conference with the principal and the science teacher for 20 to 30 minutes each. It was also planned to request an approval from the principal and the science chairperson, to have a look at the science laboratories and laboratory equipment.

These six schools were randomly selected from the ten sampled schools in Ohio. Their locations, showed by the Figure 3.4 are in different parts of the state. Thus, one day was tentatively scheduled for each school visit due to the required driving time. On April 29, the principals of these six Ohio schools were called by the investigator who briefly informed them about the purpose of the school visit and requested for an approval for visiting each school. All of them gave approval for these visits. A tentative date for the school visits and the time of the conferences were scheduled.

It was planned to request from the participating principals and teachers a response again to the selected items, in addition to a non-structured discussion with each of the participants.

All the school visits occurred during the period from May 5 to May 19, 1980. Everything took place as it was planned. Each of the participants completed the forms in 10 to 15 minutes. The conference with each of the participants also took about 15 minutes during which some conditions in teaching science in each school were discussed. In five of the six schools the investigator had a conference with the science chairperson in addition to the other selected science teacher. The investigator also visited the science laboratories and had a look at the laboratory equipment in these

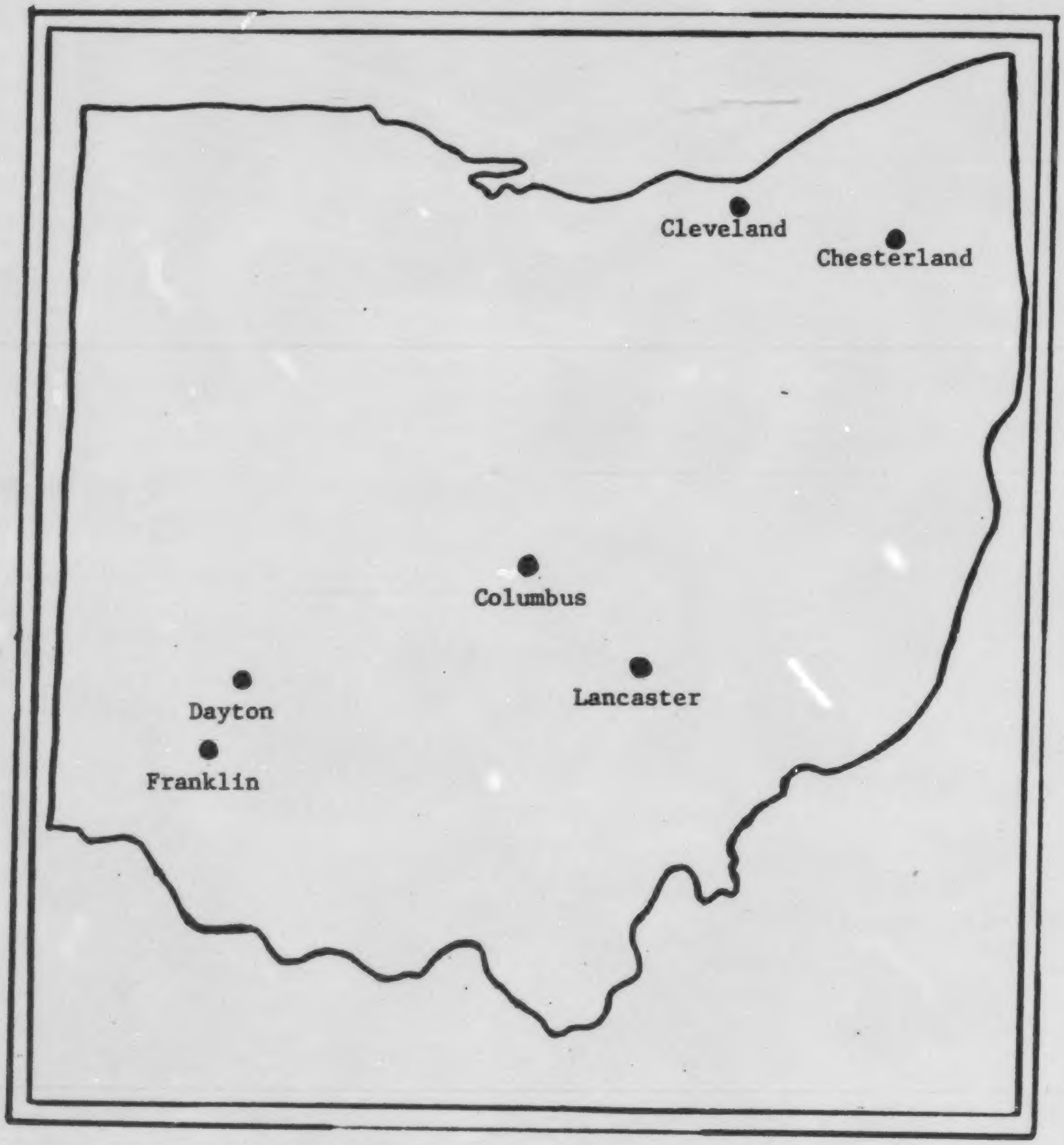
Cleveland
Chesterland
Columbus
Dayton
Lancaster
Franklin

FIGURE 3.4

THE LOCATIONS OF SCHOOLS VISITED BY THE INVESTIGATOR DURING THE PERIOD OF MAY 5, TO MAY 19, 1980 schools. Generally, the principals, the science chairperson and the selected teachers were very cooperative during these visits. The investigator got the feeling from what occurred during the visits that the principals and the teachers were supportive of the study.

It was concluded from the school and laboratory visits, conferences with the principal, the science chairperson and the selected teachers that those responses given in the initial questionnaires, which were checked by the investigator, were nearly all accurate and valid.

The reliability of the selected items of each instrument was examined by using the test-retest method. The second group of responses of each of the principals and the teacher's were compared with the initial group of responses. Table 3.11 shows that the percentage of agreement and similarity between the two item groups for the principals and the teachers ranged from about 80 percent to 94 percent. These results are similar to data obtained in evaluations of the instruments used in previous studies.

A Fisher Sign Test was also computed according to Hallander and Wolfe (1973, pp. 39-45, 258) testing the significance of difference of agreements and disagreements. The second group of responses were compared for agreement and disagreement with the initial group of responses. Items scored in agreement was allocated "+" values and disagreements were allocated "-" values. It was found that the value of probability of significance (p) ranged from ≤ 0.0003 to ≤ 0.0035. It was concluded that there were no major significant differences between the initial responses and the second responses.

TABLE 3.11

PERCENTAGE OF AGREEMENT BETWEEN THE SECOND GROUP OF RESPONSES AND THE INITIAL GROUP OF RESPONSES OF PRINCIPALS AND TEACHERS

Principal's Instruments	Percent of agreement between the second and the initial responses	Teacher's Instruments	Percent of agreement between the second and initial responses
Q:SP	94.4	Q:ST	93.3
Q:AP	83.3	Q:AT	88.9
CAST:PP	83.3	CAST:TP	79.2
TOTAL	86.7	TOTAL	88.9

Validity of Instruments

(1) Content Validity of (Q:SP), (Q:ST), (Q:AP) and (Q:AT):

In order to determine the validity of the four questionnaires (Q:SP, Q:ST, Q:AP, Q:AT), developed for the purpose of this study, the draft of each questionnaire was submitted to science education faculty members and doctoral candidates as well as some science supervisors, administrators and science teachers for their comments, criticisms and suggestions. The questionnaires were also distributed to 12 secondary schools in three states: Ohio, Pennsylvania and Michigan.

Some modification was done in the phraseology of items where they were considered vague or ambiguous as a result of the analysis of the returned responses from the schools and from the suggestions and comments received.

The members of the investigator's doctoral committee agreed that the nature of the specific items, and the proportion of items devoted to each area for each questionnaire, were appropriate to the rationale and objectives of the study.

(2) Content Validity of (CAST:PP) and (CAST:TP):

The (CAST:PP) and (CAST:TP) were used in the pilot study with other instruments to determine their potential use and value in this study.

The validity of the Checklist for Assessment of Science Teacher (CAST) was previously checked in several studies. The validity of part A based on Leeds' work with the Minnesota Teacher Attitude Inventory (Leed and Cook, 1947) was checked by

Williamson. The validity of part B developed by Williamson was checked by Howe. The validity of part C developed by Brown and Howe from work by Sagness and Howe was checked by Brown and Howe (Brown, 1972). Later Swami (1975) examined the validity of the CAST.

Reliability of Instruments

(1) Reliability of (CAST:PP) and (CAST:TP)

Brown (1972) reported the reliability estimates for (CAST:PP). He found that KR-20 and KR-21 estimates were 0.74 and 0.71, respectively, (CAST:PP) using a sample of 327 subjects. Swami (1975) used the checklist for evaluating different aspects of the preservice teacher education program at The Ohio State University. The CAST:PP was administered by Swami to administrators and he found that Hoyt's reliability estimate was 0.77.

The reliability (internal consistency) for (CAST:PP) and (CAST:TP) was estimated for this study by using the SPSS Subprogram Reliability to compute the reliability coefficient "Cronbach's alpha". Each checklist was divided into two clusters: (1) perception of what does take place; and (2) perception of what should take place. Each cluster of items on the checklist was analyzed to compute the reliability coefficient (Cronbach's alpha) to determine the internal consistency of each checklist. Each checklist was also tested for reliability with the two clusters combined. Data on Table 3.12 show that the internal consistency reliability coefficient (Cronbach α) for the principals (CAST:PP) was 0.898 for the first cluster of items and 0.939 for the second cluster. The reliability coefficient (Cronbach α) for the total CAST:PP was 0.933. With respect to the CAST:TP, the internal consistency reliability coefficient (Cronbach α) for the teachers was 0.717 for the first cluster of items and 0.862 for the second cluster. The reliability coefficient (Cronbach α) for the total CAST:TP was 0.843.

(2) Reliability for the questionnaire for the attitudes toward change in Science Education (Principal's Questionnaire Q:AP and Teacher's Questionnaire Q:AT)

The reliability (internal consistency) for the (Q:AP) and the (Q:AT) was estimated using the SPSS Subprogram Reliability to compute "Cronbach's alpha" reliability coefficient. Each questionnaire was divided into seven clusters: (1) decision making; (2) changes in science curriculum and instruction; (3) resources of new science materials and programs; (4) information about science materials and practices; (5) federal support for curriculum development; (6) science programs; and (7) barriers to change.

Each questionnaire was also tested for reliability with all the clusters combined. Data on Table 3.13 presents the internal consistency reliability coefficient (Cronbach α) for (Q:AP) and (Q:AT).

The internal consistency reliability coefficient ranged from 0.544 to 0.978 for the principals (Q:AP) over the seven

TABLE 3.12

INTERNAL CONSISTENCY RELIABILITY ESTIMATES (CRONBACH ALPHA) FOR CAST:PP AND CAST:TP

		CAST:PP	CAST:TP
		Principals (N=100)	Teachers (N=288)
Cluster of Items	Number of Items	Reliability Coefficient (Cronbach α)	Reliability Coefficient (Cronbach α)
CAST: IS	5	0.898	0.717
CAST: SHOULD	5	0.939	0.862
CAST: TOTAL	10	0.933	0.843

clusters. With all the seven clusters combined, the reliability coefficient (Crombach α) was 0.959 for the principals. On the other hand, the internal consistency reliability coefficient ranged from 0.459 to 0.929 for the teachers (Q:AT) over the seven clusters. With all seven clusters combined, the reliability coefficient was 0.927 for the teachers.

(3) Reliability of the Survey Questionnaires (Principal's Questionnaire Q:SP and Teacher's Questionnaire Q:ST)

Some of the (Q:SP) and (Q:ST) items were chosen as representative items, as reported before in the school visits, to be re-analyzed after the period of time of the initial responses using test-retest procedures. The second group of responses of the principals and the teachers were compared for agreement and disagreement with the initial group of responses. Items scored in agreement were allocated "+" values and disagreements were allocated "-" values.

A Fisher Sign Test was computed testing the significance of difference of agreements and disagreements. It was found that the probability of significance (p) was $\leqslant 0.0003$ for each of the principals and the teachers. The percentage of the similarity and agreement between second group of responses and the first group of responses were found also to be 94.4 percent for the principals and 93.3 percent for the teachers. This indicates that there were no significant differences between the first responses and the second responses.

TABLE 3.13

INTERNAL CONSISTENCY RELIABILITY ESTIMATES (CRONBACH ALPHA) FOR (Q:AP) AND (Q:AT)

Cluster of items	(Q:AP)		(Q:AT)	
	Principals (N=100)		Science Teachers (N=288)	
	Number of items	Reliability Coefficient (Cronbach α)	Number of items	Reliability Coefficient (Cronbach α)
Decision Making	20	0.976	20	0.792
Changes in Science Curriculum and Instruction	10	0.977	10	0.813
Resources of new Science Materials and Progress	34	0.978	35	0.873
Information about Science Materials and Practices	40	0.902	40	0.929
Federal Support for Curriculum Development	10	0.544	10	0.459
Science Programs	12	0.857	12	0.824
Barriers to Change	32	0.949	32	0.909
Total	158	0.959	159	0.927

Reliability of Data

The reliability of the data for this study in terms of the probable range of responses for a given variable was determined by using the formula indicated by Wert et al. (1954) to find the standard error of a proportion. This formula is:

$$\text{standard error or confidence level} = \pm 1.96 \sqrt{\frac{P(1-P)}{N}}$$

where p = the percentage of responses on any variable

N = the total number of responses on any variable

± 1.96 = the constant for the 0.05 level of significance

Considering possible sampling error based on number and distribution of returns, the probable extreme confidence interval would be, in the case of teachers (n = 288):

$$\text{standard error or confidence interval} = \pm 1.96 \sqrt{\frac{P(1-P)}{n}}$$

$$= \pm 1.96 \sqrt{\frac{0.50(1-0.50)}{228}}$$

$$= \pm 1.96 \text{ X}.0295$$

$$= \pm .058 \text{ or } \pm 5.8\%$$

A 50-50 split on a dichotomous variable (see example above) would produce the greatest standard error. Most variables resulted in other than a 50-50 split. Therefore, this estimate of error is greater than the error for most variables.

The value of 5.8 percent indicated in the example implies that on dichotomous items with a 50-50 split (when half of the respondents gave identical responses) the percentages of true responses to the item would be between 44.2 percent and 55.8 percent.

Table 3.14 gives the extreme confidence level of the percentages of responses on any variable for the three units of analysis of this study.

Table 3.14

RELIABILITY OF DATA
THE EXTREME CONFIDENCE LEVEL OF RESPONSES ON TEACHERS, PRINCIPALS AND SCHOOL VARIABLES

Unit of Analysis	Number (N) of Usuable Questionnaires	Extreme Confidence level
Teachers	288	± 5.8%
Principals	100	± 9.8%
Schools	98	± 9.9%

According to the Table the extreme confidence level of percentages of responses on given school variables was established at a value of ± 9.9 percent. This was true for the schools which consisted of the smallest sample size. The range of the responses was determined to be less for the principals and the teachers. Since the ratio of responses on most variables was other than a 50-50 split, the probable confidence interval was much narrower than that indicated by Table 3.14.

Follow-up Procedures and Response Rate

Follow-up Procedures

Because the materials were posted to the selected schools over a period of about three months, from November 15, 1979 to February 15, 1980, the strategy of the follow-up was to wait until all the materials had been mailed to all the selected schools and then start the follow-up procedures. Data on Table 3.7 show that some completed questionnaires were being received from all the selected states by March 1, 1980. Consequently, the follow-up procedures started on March 1, 1980. These procedures were completed in four phases.

First Phase

The procedures undertaken in the first follow-up phase were:

1. A follow-up form in addition to a cover letter and a stamped addressed envelope were mailed to each principal of the sample schools which did not send all the principals and the teachers questionnaires (See Appendix D). Principals were requested to call or write the ERIC Clearinghouse if they had not received the materials or if they desired clarification of any aspects of the study.
2. A letter was mailed to each state science supervisor thanking him or her for cooperation and for helping in the distribution of the questionnaire packets. A list of the principals and the teachers who mailed their materials back to the investigator was attached to each letter to inform each state science supervisor about the response rate in his or her state.

Each state science supervisor was requested to contact the nonrespondents, if he or she was willing to help in the follow-up process (See Appendix D). On March 7, 1980, the state science supervisors were called to check whether they were willing to contact the nonrespondents and help in the follow-up process. Eight of the nine state science supervisors expressed their willingness to cooperate and to periodically contact their schools and to inform them about the response rate in their states.

Second Phase

The procedures used in the second follow-up phase were:

1. On March 29, 1980, a second follow-up form with a cover letter and a stamped addressed envelope were posted to those remaining schools which had not returned all the principals' and teachers' completed materials. In addition, a sketch (See Appendix D) was attached to each follow-up form to stimulate these principals and teachers who had not responded.
2. Follow-up letters were posted on March 29, 1980, to the state science supervisors with lists of respondents and urging their cooperation.
3. Phone calls were made to the principals of the schools who had not returned any principals' or teachers' questionnaires to determine the reasons for not responding completely.

It was found that the reasons for nonresponse were:

1. Some of these schools did not receive the materials. Thus, additional materials were sent to the schools which

requested them.

2. Some of the principals (five principals in three states) reported that they received the materials, but they could not participate without having an approval from the science consultant (supervisor) of their school districts. Thus, the same procedures in contacting these school district science supervisors were undertaken similar to those done with the state science supervisor. A packet of material was sent to each one. This was followed by phone calls to the school district science supervisors requesting their cooperation and knowing their responses. Their responses were positive and approval was given to their schools to participate in the study.

Third Phase

The procedures used in the third follow-up phase were:

1. On April 30, 1980, a third follow-up form in addition to a cover letter, the sketch and a stamped addressed envelope were mailed to each principal of the schools which had not responded completely.
2. A follow-up letter and a list of the respondents in each state were sent to each state science supervisor.
3. On May 7, 1980, the principals of schools which had not returned any questionnaire and of schools with very low response rates were contacted by phone. State science supervisors were also called to provide them with information about these cases.

Fourth Phase

The procedures used in the fourth follow-up phase were:

1. On May 30, 1980, a final follow-up letter was posted to the remaining schools which had not completed their responses. A letter was also sent to each state science supervisor.
2. On June 4, 1980, the state science supervisors and the schools which had not sent all the responses were contacted by phone.

No further follow-up mailings or phones were made after June 4, 1980. The cut-off date for the return of questionnaires was June 20, 1980.

By June 20, the final cut-off date, questionnaires had been received from 98 percent of the principals and approximately 94 percent of the teachers. Eighty-eight schools, representing 88 percent of the sample schools returned all the principals' and teachers' questionnaires completed (Table 3.19). The high response rate came as a result of great efforts in the follow-up process. The majority of the state science supervisors were very cooperative and very supportive of the study. Some sent the materials to the selected schools in their states with very supportive letters urging the principals to participate in the study; others sent follow-up letters to the nonrespondents. The follow-up letters and telephone calls were factors in increasing the response rat

Response Rate

As questionnaires started to return, the investigator kept an accurate record of completed questionnaires received. The response rate is reported with regard to three types of unit of analysis which are the school, the principal and the teacher.

The School

The response rate of the schools is categorized in three groups: (1) schools that returned all the responses from the principal and from all the selected science teachers (usually three teachers), (2) schools that returned the responses from the principal and two of the three selected teachers and (3) schools that returned responses from the principal and only one science teacher. Data on Table 3.15 presents the response rate of the schools that completed all the questionnaires.

Eighty-eight schools returned all the questionnaires. This number represents a response rate of 88 percent of the sample schools. Data on Table 3.16 show that 94 schools returned the questionnaires completed by the principal and two of the three selected teachers. This number represents a response rate of 94 percent of the sample schools. On the other hand 98 schools returned the questionnaires completed by the principal and only one of the three selected science teachers. This number represents a response rate of 98 percent of the sample schools.

The Principal

One hundred principals returned the completed questionnaires. This number represents a response rate of 98 percent of the sample schools. The response rate of the principals for eight states was 100 percent and 90 percent for the other two states. (Table 3.17)

TABLE 3.15

RESPONSE RATE OF SECONDARY SCHOOL THAT PARTICIPATED IN THE STUDY AND COMPLETED ALL PRINCIPALS' AND TEACHERS' QUESTIONNAIRES

	Sample size of secondary schools	Secondary schools that returned all responses from the principal and selected teachers	
State	Number	Number	Percent
Ohio	10	10	100.0
Oregon	10	7	70.0
Connecticut	10	9	90.0
Pennsylvania	10	10	100.0
Texas	10	9	90.0
Colorado	10	10	100.0
Iowa	10	9	90.0
Missouri	10	10	100.0
Alabama	10	7	70.0
Florida	10	7	70.0
Total	100	88	88.0

TABLE 3.16

RESPONSE RATE FOR SECONDARY SCHOOLS BY STATE AND SCHOOL

State	Sample size Number of schools	Schools that returned all responses from principal and selected teachers		Schools that returned responses from principal and two teachers		Schools that returned responses from principal and one teacher	
		Number of complete school response	Percent of complete school response	Number of schools	Percent of schools	Number of schools	Percent of schools
Ohio	10	10	100.0	10	10.0	10	100.0
Oregon	10	7	70.0	8	80.0	10	100.0
Connecticut	10	9	90.0	9	90.0	9	90.0
Pennsylvania	10	10	100.0	10	100.0	10	100.0
Texas	10	9	90.0	9	90.0	10	100.0
Colorado	10	10	100.0	10	100.0	10	100.0
Iowa	10	9	90.0	10	100.0	10	100.0
Missouri	10	10	100.0	10	100.0	10	100.0
Alabama	10	7	70.0	8	80.0	9	90.0
Florida	10	7	70.0	10	100.0	10	100.0
Total	100	88	88.0	94	94.0	98	98.0

TABLE 3.17

RESPONSE RATE FOR SECONDARY SCHOOL PRINCIPALS BY STATE AND PRINCIPAL

State	Sample size of principals	Principals who participated in the study	
	Number of principals	Number of principals	Percent of principals
Ohio*	11	11	100.0
Oregon*	11	11	100.0
Connecticut	10	9	90.0
Pennsylvania	10	10	100.0
Texas	10	10	100.0
Colorado	10	10	100.0
Iowa	10	10	100.0
Missouri	10	10	100.0
Alabama	10	9	90.0
Florida	10	10	100.0
Total	102	100	98.0

*One of the selected schools in Ohio and another one in Oregon have two buildings with one principal for each building

TABLE 3.18

RESPONSE RATE FOR SECONDARY SCHOOL SCIENCE TEACHERS BY STATE AND TEACHER

State	Sample size of teachers	Science teachers who participated in the study	
	Number of teachers	Number of teachers	Percent of Teachers
Ohio*	36	36	100.0
Oregon*	36	31	86.1
Connecticut	30	29	96.7
Pennsylvania	30	30	100.0
Texas**	29	27	93.1
Colorado	30	30	100.0
Iowa***	28	27	96.4
Missouri	30	30	100.0
Alabama**	29	22	75.9
Florida**	29	26	89.7
Total	307	288	93.8

*Two of the selected schools in Ohio and Oregon have two buildings
**One of the selected schools in Texas, Alabama and Florida has only two science teachers
***Two of the selected schools in Iowa have only two science teachers

The Teachers

From the sampled teachers, 288 teachers returned their questionnaires completed. This number represents a response rate of approximately 94 percent. The response rate of the teachers for 4 states was 100 percent, above 90 percent for another 4 states and above 76 percent for the other two. (Table 3.18)

Response Rate During the Period from January to June 1980

Data on Table 3.19 presents the response rate for the three units of analysis, the principal, the teacher and the school, during the period from January, 1980, to June, 1980. Returned materials started to be received on January 7, 1980. The date of receiving returned materials from each respondent was written on each questionnaire. A variable for the return state for each respondent was generated and added to the SQ:P and SQ:T variables. Returned responses were counted every two weeks starting January 19, 1980. The number of returned responses from the principals and the teachers is presented for every two weeks. Also, the number of schools having all questionnaires completed are presented.

Data show that by the end of March, 1980, returned responses were received from about 65 percent of the principals and the teachers and from 44 percent of the schools in the sample. About 82 percent of the principals, 84.7 percent of the teachers, and 64 percent of the schools returned their completed questionnaires by April 26, 1980. By the end of May, 1980 responses were received from 89 percent of the schools. Finally, by June 21, 1980, responses were received from

TABLE 1.19

RESPONSE RATE FOR PRINCIPALS, TEACHERS, AND SCHOOLS DURING THE PERIOD FROM JANUARY TO JUNE 1980

STATE	1/19			2/2			2/16			3/1			3/15			3/29			4/12			4/26			5/10			5/24			6/7			6/21		
	P	T	S	P	T	S	P	T	S	P	T	S	P	T	S	P	T	S	P	T	S	P	T	S	P	T	S	P	T	S	P	T	S	P	T	S
Ohio	2	7	0	4	15	1	7	19	2	8	20	1	9	24	6	10	30	7	10	31	7	10	32	8	10	32	8	10	35	9	11	36	10	11	36	10
Oregon	1	0	0	0	2	0	0	0	0	3	3	0	2	6	0	5	8	0	6	18	5	5	23	2	8	28	5	8	28	5	10	31	6	11	31	7
Connecticut	0	0	0	1	5	1	3	9	2	6	11	2	5	15	3	6	22	5	7	25	5	8	27	6	8	28	8	8	29	8	8	29	8	9	29	9
Pennsylvania	3	14	3	3	16	4	4	18	4	8	27	6	9	28	7	10	32	9	10	30	10	10	30	10	10	30	10	10	30	10	10	30	10	10	30	10
Texas	4	4	1	4	9	1	4	9	1	4	12	1	4	12	1	5	13	3	7	20	6	8	23	5	8	25	7	8	25	7	9	27	9	10	27	8
Colorado	3	7	0	5	15	1	6	17	3	6	18	4	7	18	6	7	22	5	8	25	7	9	29	8	9	29	8	10	30	10	10	30	10	10	30	10
Iowa	6	11	4	7	20	5	7	21	5	9	27	8	10	27	9	10	27	9	10	27	9	10	27	9	10	27	9	10	27	9	10	27	9	10	27	9
Missouri	0	0	0	0	0	0	0	0	0	4	5	0	6	13	2	8	16	3	7	18	6	8	25	5	10	30	10	10	30	10	10	30	10	10	30	10
Alabama	2	14	1	3	11	2	3	11	2	3	12	2	3	12	3	1	12	3	6	15	3	8	21	6	8	21	6	8	22	7	8	22	7	9	22	7
Florida	0	0	0	0	0	0	0	0	0	6	13	2	6	17	3	6	20	3	7	22	4	9	24	5	9	24	5	9	26	5	9	25	5	10	26	7
Total	22	57	10	27	91	15	34	104	19	56	148	28	61	173	36	66	199	44	76	231	54	84	260	64	89	274	76	91	280	80	96	287	84	100	288	88
Percent	21.6	18.6	10	26.5	29.6	15	33.3	33.9	19	54.9	48.2	28	59.8	56.4	36	64.7	64.8	44	74.5	75.2	54	82.4	84.7	64	87.3	89.3	76	89.2	91.2	80	94.1	93.5	84	98	93.8	88

P = Principal
T = Science Teacher
S = Secondary School that completed all
the questionnaires

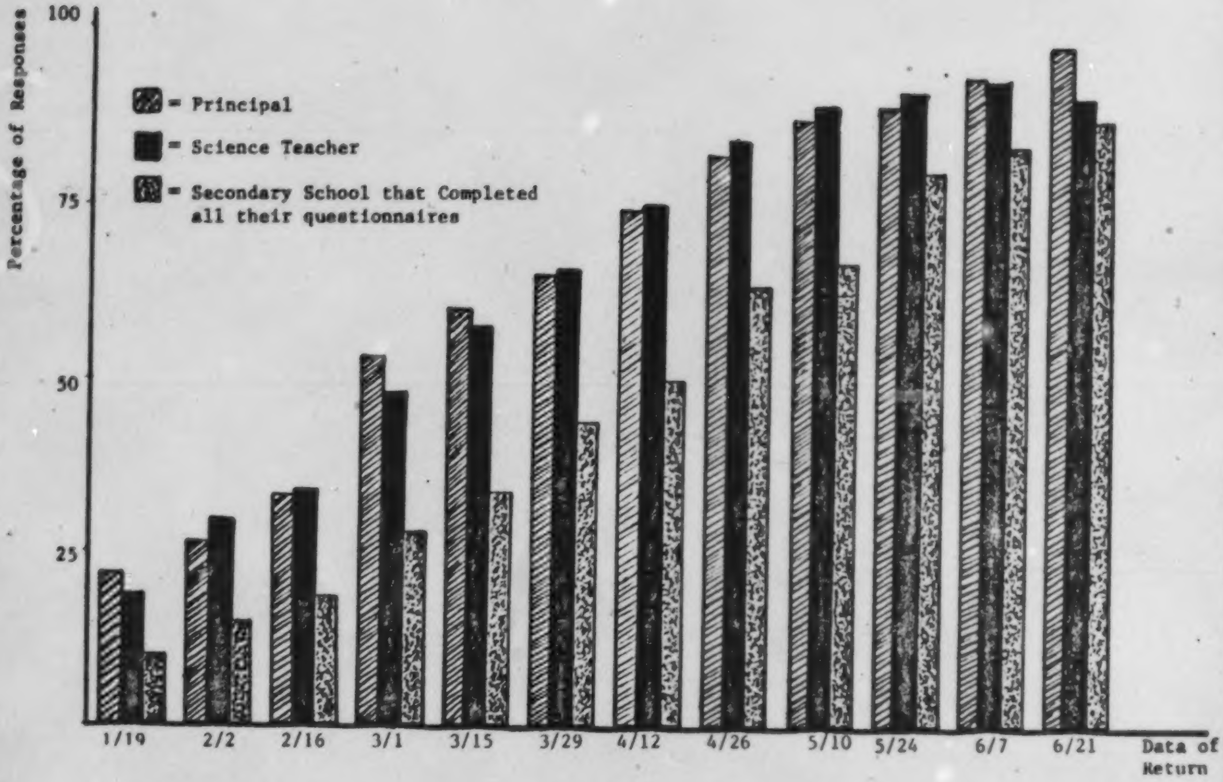

FIGURE 3.5

RELATIONSHIP BETWEEN THE DATA OF RESPONSE RETURN AND THE PERCENTAGE OF RESPONSES FOR THE PRINCIPALS, TEACHERS AND SCHOOLS PARTICIPATING IN THE STUDY

98 percent of the principals, about 94 of the teachers and 88 percent of the schools in the sample. Figure 3.5 presents the relationship between the date of the response return and the percentage of responses for the principals, teachers and schools participating in the study.

Analysis of Data

Coding of Questionnaire Responses:

Coding keys were developed for the principals' and the science teachers' questionnaire using numeric codes. The eleven digit identity code number for each principal and teacher was the same as that of the 1970-71 OSU study. In addition, one more digit was assigned to indicate the code number of each principal or teacher in the school. Thus, each principal or teacher was identified by a 12 digit identification code representing the following:

Column 1	Level: 2 = Secondary
Column 2	Respondent: 1 = Teacher, 2 = Principal
Column 3	Region
Column 4-5	State
Column 6-8	County
Column 9-11	School
Column 12	Principal's number or teacher's number

Key-punching Coded Data

The coded data in the questionnaires were key-punched onto standard computer cards. A total of nine computer cards were required to accommodate the data from each Q:SP or Q:ST questionnaire. Four computer cards were required to accommodate the data in both Q:AP and CAST:PP or both Q:AT and CAST:TP. The total number of computer cards for each principal or teacher was 13 cards. About 5500 cards were punched and verified for this study. Cards were arranged by school sampled and then by state.

The SPSS Subprogram "Frequencies" was run for each instrument for each state and the responses were checked to determine where possible coding or keypunching errors had been made. Corrections were made when errors were found.

Analysis of the Data

When the punched cards were believed to be completely accurate the analysis of the data was begun. Specific statistical treatments of the data were accomplished through the use of the Statistical Package For the Social Sciences (SPSS) (1975), New Procedures and Facilities for Releases 7 and 8 (SPSS Update) (1979) and SAS User's Guide (1979).

Descriptive Analysis

The SPSS Subprogram "Frequencies" was used to accumulate basic descriptive statistics on the data collected from various instruments. Descriptive data involved finding percentages and frequencies of responses to the items on the principals' and teachers' questionnaires as well as determining means and standard deviations.

Correlation

Correlation coefficients for all independent and criterion variables were obtained using the SPSS Subprogram "Pearson Correlation." The use of the Pearson Product Moment Correlation Coefficient analyzing dichotomous data is supported by Costner (1971).

The intercorrelations of all the variables of each of the principals' questionnaires and teachers' questionnaires were computed using the SPSS Subprogram Pearson Correlation; the resulting correlations totaled about 252,000 for Q:SP, 278,000 for Q:ST and 43,000 for each of Q:AP and Q:AT. The total number of correlations for all the principals' and teachers' instruments was 573,000 correlations. Each variable was analyzed on all other variables of the same instruments.

Selection of Variables for Further Analysis:

The purpose of selecting significant variables of each instrument was to identify important variables with a potential contribution for predicting the criterion variables as well as for indicating patterns existing between variables. The strategy for selecting variables that could be used for further analysis was to eliminate any variable which did not meet two criteria: (1) the frequency of the variable was not low (equal to or greater than 5 percent); and (2) the correlation significance of the variable with other variables (p) of greater than $\ll$ .05. Thus, the following two actions were undertaken to select the important variables:

(1) The SPSS output Frequencies of each instrument was scanned to keep each variable with a frequency of $\gg$ .5 percent. Thus, all variables that occurred at least five times in every 100 cases were retained. This action resulted in deleting a number of variables from each instrument. (2) The SPSS output, Pearson Correlation,of each instrument was scanned. A tally was created for each variable documenting the number of times it correlated with other variables at *p's* of greater than $\ll$.05. Variables showing correlations at these levels of significance in totals greater than that explainable by chance (i.e. at least five percent significant r's), were selected for further analysis.

These two actions resulted in the deletion of a high number of variables from the (Q:SP) and (Q:ST). Of the 502 variables of the (Q:SP) , 160 variables were retained. Of the 527 of the Q:ST, 166 variables were retained. On the other hand,only 33 variables were deleted from the (Q:AP) AND (Q:AT) and not any of the (CAST:PP) and (CAST:TP) variables were deleted.

The names, abbreviations and coding for the remaining variables for the (Q:ST), (Q:SP), (Q:AP), (Q:AT), (CAST:PP) and (CAST:TP) are presented in Tables 3.20, 3.21 and 3.22.

Reliability

The SPSS Subprogram Reliability was used to compute the reliability coefficient "Cronbach's alpha" for (Q:AP), (CAST:PP) and (CAST:TP).

Change Variables between 1970/71 and 1979/80

Common variables in both the 1970/71 and 1979/80 studies were identified. The unit of analysis used for the change variables was the school building, consequently, the identification of common variables in both the 1970/71 and 1979/80 studies was delimited only to the principal's survey questionnaires of 1970/71 and 1979/80.

A computer run on the original data tapes of 1970/71 OSU study was done and a deck of cards for the principal's questionnaire was provided. A total of nine computer cards were provided for each principal of the 94 schools that were used for the analysis of the change section.

Descriptive statistics for 1970/71 and 1979/80 on the 75 common variables were obtained using SPSS Subprogram "Frequencies."

Change variables between 1970/71 and 1979/80 were computed using SPSS (1975) and SAS (1979) computer packages. Descriptive data for these change variables were obtained.

A Two-way Crosstabulation Table was obtained using SAS to examine the changes in the types of schools between 1970/71 and 1979/80 school years.

A series of t-tests for each of the change variables was computed to test the significance of the change variables using SPSS and SAS computer packages.

Relationship between Change Variables and State Control of Education

Two types of analyses were used to test the relationship between the change variables and the State Control of Education.

1. Analysis of Variance (ANOVA).

   Analysis of Variance for Unbalanced Data was used to test the differences in the continuous variables among states of high, average and low control of education using SAS "GLM Procedure Reference."

2. Scattergram Plot

   Scattergram Graphs were obtained to show the relationship between the change variables and State Control of Education using the SPSS Subprogram "Scattergram."

TABLE 3.20

Names, Abbreviations and Coding for the Remaining Variables of the Principal's Questionnaire for the Status of Science Teaching in Public Secondary Schools (Q:SP)

I. SCHOOL ORGANIZATION:

No.	Abbreviation	Name	Code
1	Type JR	Grade 7-9	1 = yes, 0 = no
2	Type HS	Grade 9-12	1 = yes, 0 = no
3	Type SHS	Grade 10-12	1 = yes, 0 = no
4	Roll G7	Enrollment for Grade 7	Number
5	Roll G8	Enrollment for Grade 8	Number
6	Roll G9	Enrollment for Grade 9	Number
7	Roll G10	Enrollment for Grade 10	Number
8	Roll G11	Enrollment for Grade 11	Number
9	Roll G12	Enrollment for Grade 12	Number
10	Tot Roll	Total	Number
11	Stud Roll Dec	Decrease in Students Number	1 = yes, 0 = no
12	Stud Roll NC	No Change in Students Number	1 = yes, 0 = no
13	Stud Roll Inc	Increase in Students Number	1 = yes, 0 = no
14	Sci Roll Dec	Decrease in Precentage of Science Enrollment	1 = yes, 0 = no
15	Sci Roll NC	No Change in Percentage of Science Enrollment	1 = yes, 0 = no
16	Sci Roll Inc	Increase in Percentage of Science Enrollment	1 = yes, 0 = no
17	Sci Req 1	Less than One Year Required for Science	1 = yes, 0 = no
18	Sci Req 2	One Year Required for Science	1 = yes, 0 = no
19	Sci Req 3	More than One Year Required	1 = yes, 0 = no
20	Course Req	Having Required Science Courses	1 = yes, 0 = no

II. PRINCIPAL:

21	Prin 70	Working 70/71 at the Same School	1 = yes, 0 = no
22	Prin Ad	Working 70/71 as Administrator	1 = yes, 0 = no
23	Prin Teach	Working 70/71 as Teacher	1 = yes, 0 = no
24	Prin Year	Number of Years Working as Principal	Number

III. SCIENCE TEACHERS:

25	Teach Sci M	Number of Male Science Teachers	Number
26	Teach Sci F	Number of Female Science Teachers	Number
27	Teach Sci M_1	Number of Male Science Teachers with 0-20% Assignment	Number
28	Teach Sci F_1	Number of Female Science Teachers with 0-20% Assignment	Number
29	Teach Sci T_1	Total Number of Science Teachers with 0-20% Assignment	Number
30	Teach Sci M_2	Number of Male Science Teachers with 21-40% Assignment	Number
31	Teach Sci F_2	Number of Female Sci Teachers with 21-40% Assignment	Number
32	Teach Sci T_2	Total Number of Sci Teachers with 21-40% Assignment	Number
33	Teach Sci M_3	Number of Male Sci Teachers with 41-60% Assignment	Number
34	Teach Sci F_3	Number of Female Sci Teachers with 41-60% Assignment	Number
35	Teach Sci T_3	Total Number of Sci Teachers with 41-60% Assignment	Number
36	Teach Sci M_4	Number of Male Sci Teachers with 61-80% Assignment	Number
37	Teach Sci F_4	Number of Female Sci Teachers with 61-80% Assignment	Number
38	Teach Sci T_4	Total Number of Sci Teachers with 61-80% Assignment	Number
39	Teach Sci M_5	Number of Male Sci Teachers with 81-100% Assignment	Number
40	Teach Sci F_5	Number of Female Sci Teachers with 81-100% Assignment	Number
41	Teach Sci T_5	Total Number of Sci Teachers with 81-100% Assignment	Number

IV. SCIENCE BUDGET:

42	Sci Eq	Science Equipment Budget	1 = yes, 0 = no
43	Eq Budg	Equipment Budget per Student	Number
44	Sci Sup	Science Supplies Budget	1 = yes, 0 = no
45	Sup Budg	Supplies Budget per Student	Number
46	Teach Pur Eq	Teacher Purchase of Sci Equipment and Supplies	1 = yes, 0 = no
47	Book	School Budget for Textbooks	1 = yes, 0 = no
48	Book Budg	Books Budget per Student	Number
49	Budg Cut	Budget Cuts	1 = yes, 0 = no
50	Mor Book	More Teaching from Textbooks	1 = yes, 0 = no
51	Less Mon	Less Money for Instructional Materials	1 = yes, 0 = no
52	Red Cours	Optional Courses Reduced	1 = yes, 0 = no
53	Red Inser	Inservice Training Reduced	1 = yes, 0 = no
54	Teach Prep	Teachers Assigned to Teach Subjects with Little or No Background Preparation	1 = yes, 0 = no

TABLE 3.20 (CONTINUED)

V. COURSE OFFERINGS:

	Biology		
55	BSCS G	Use of BSCS Green	1 = yes, 0 = no
56	BSCS G G9	Enrollment in BSCS Green in Grade 9	1 = yes, 0 = no
57	BSCS G G10	Enrollment in BSCS Green in Grade 10	1 = yes, 0 = no
58	BSCS G G11	Enrollment in BSCS Green in Grade 11	1 = yes, 0 = no
59	BSCS G G12	Enrollment in BSCS Green in Grade 12	1 = yes, 0 = no
60	BSCS Y	Use of BSCS Yellow	1 = yes, 0 = no
61	BSCS Y G10	Enrollment in BSCS Yellow in Grade 10	1 = yes, 0 = no
62	BSCS Y G11	Enrollment in BSCS Yellow in Grade 11	1 = yes, 0 = no
63	BSCS B	Use of BSCS Blue	1 = yes, 0 = no
64	Oram	Use of Living Systems (Oram)	1 = yes, 0 = no
65	Oram G10	Enrollment in Oram in Grade 10	1 = yes, 0 = no
66	Oram G11	Enrollment in Oram in Grade 11	1 = yes, 0 = no
67	Oram G12	Enrollment in Oram in Grade 12	1 = yes, 0 = no
68	Smallwood	Use of Biology (Smallwood)	1 = yes, 0 = no
69	Smallwood G10	Enrollment of Smallwood in Grade 10	1 = yes, 0 = no
70	Smallwood G11	Enrollment of Smallwood in Grade 11	1 = yes, 0 = no
71	Smallwood G12	Enrollment of Smallwood in Grade 12	1 = yes, 0 = no
72	Heimler	Use of Focus on Life Science (Heimler)	1 = yes, 0 = no
73	Heimler G7	Enrollment of Heimler in Grade 7	1 = yes, 0 = no
74	Fitz	Use of Living Thing (Fitzpatrick)	1 = yes, 0 = no
75	Fitz G10	Enrollment of Fitzpatrick in Grade 10	1 = yes, 0 = no
76	Otto	Use of Biology (Otto)	1 = yes, 0 = no
77	Otto G9	Enrollment of Otto in Grade 9	1 = yes, 0 = no
78	Otto G10	Enrollment of Otto in Grade 10	1 = yes, 0 = no
79	Otto G11	Enrollment of Otto in Grade 11	1 = yes, 0 = no
80	Otto G12	Enrollment of Otto in Grade 12	1 = yes, 0 = no
	Chemistry		
81	Cotton	Use of Chemistry: An Investigative Approach (Cotton)	1 = yes, 0 = no
82	Cotton G11	Enrollment of Cotton in Grade 11	1 = yes, 0 = no
83	Cotton G12	Enrollment of Cotton in Grade 12	1 = yes, 0 = no
84	CHEMS	Use of CHEMS	1 = yes, 0 = no
85	CHEMS G10	Enrollment of CHEMS in Grade 10	1 = yes, 0 = no
86	CHEMS G11	Enrollment of CHEMS in Grade 11	1 = yes, 0 = no
87	CHEMS G12	Enrollment of CHEMS in Grade 12	1 = yes, 0 = no
88	Metcalfe	Use of Modern Chemistry (Metcalfe)	1 = yes, 0 = no
89	Metcalfe G10	Enrollment of Metcalfe in Grade 10	1 = yes, 0 = no
90	Metcalfe G11	Enrollment of Metcalfe in Grade 11	1 = yes, 0 = no
91	Metcalfe G12	Enrollment of Metcalfe in Grade 12	1 = yes, 0 = no
	Physics		
92	Williams	Use of Modern Physics (Williams)	1 = yes, 0 = no
93	Williams G11	Enrollment of Williams in Grade 11	1 = yes, 0 = no
94	Williams G12	Enrollment of Williams in Grade 12	1 = yes, 0 = no
95	PSSC	Use of PSSC	1 = yes, 0 = no
96	PSSC G11	Enrollment of PSSC in Grade 11	1 = yes, 0 = no
97	PSSC G12	Enrollment of PSSC in Grade 12	1 = yes, 0 = no
98	HPP	Use of Project Physics	1 = yes, 0 = no
99	HPP G11	Enrollment of Project Physics in Grade 11	1 = yes, 0 = no
100	HPP G12	Enrollment of Project Physics in Grade 12	1 = yes, 0 = no
	Physical Science		
101	IPS	Use of IPS	1 = yes, 0 = no
102	IPS G9	Enrollment of IPS in Grade 9	1 = yes, 0 = no
103	Tracy	Use of Modern Physical Science (Tracy)	1 = yes, 0 = no
104	Tracy G11	Enrollment of Tracy in Grade 11	1 = yes, 0 = no
	Earth Science		
105	Namowitz	Use of Earth Science (Namowitz)	1 = yes, 0 = no
106	Bishop	Use of Focus on Earth Science (Bishop)	1 = yes, 0 = no
107	ESCP	Use of ESCP	1 = yes, 0 = no
108	ESCP G9	Enrollment of ESCP in Grade 9	1 = yes, 0 = no
	Other Courses		
109	ISCS	Use of ISCS	1 = yes, 0 = no
	General Science		
110	GS	Offering a General Science Course	1 = yes, 0 = no
111	GS G9	Enrollment in General Science in Grade 9	1 = yes, 0 = no
112	GS G10	Enrollment in General Science in Grade 10	1 = yes, 0 = no

TABLE 3.20 (CONTINUED)

Specialized Science Courses

113	Spec Course	Offering Specialized Courses	1 = yes, 0 = no
114	Astro	Offering of An Astronomy Course	1 = yes, 0 = no
115	Astro Book	Use of Astronomy Textbook(s)	1 = yes, 0 = no
116	Astro G10	Enrollment of Astronomy in Grade 10	1 = yes, 0 = no
117	Astro G11	Enrollment of Astronomy in Grade 11	1 = yes, 0 = no
118	Astro G12	Enrollment of Astronomy in Grade 12	1 = yes, 0 = no
119	Physio	Offering of a Physiology Course	1 = yes, 0 = no
120	Physio Book	Use of Physiology Textbook(s)	1 = yes, 0 = no
121	Physio G10	Enrollment of Physiology in Grade 10	1 = yes, 0 = no
122	Physio G11	Enrollment of Physiology in Grade 11	1 = yes, 0 = no
123	Physio G12	Enrollment of Physiology in Grade 12	1 = yes, 0 = no
124	Zoology	Offering a Zoology Course	1 = yes, 0 = no
125	Botany	Offering a Botany Course	1 = yes, 0 = no
126	Botany Book	Use of Botany Textbook(s)	1 = yes, 0 = no
127	Botany G11	Enrollment of Botany in Grade 11	1 = yes, 0 = no
128	Ocean	Offering an Oceanography Course	1 = yes, 0 = no
129	Ocean Book	Use of Oceanography Textbook(s)	1 = yes, 0 = no
130	Ocean G11	Enrollment of Oceanography in Grade 11	1 = yes, 0 = no
131	Ocean G12	Enrollment of Oceanography in Grade 12	1 = yes, 0 = no
132	Geology	Offering a Geology Course	1 = yes, 0 = no
133	Geology Book	Use Geology Textbook(s)	1 = yes, 0 = no
134	Geology G10	Enrollment in Geology in Grade 10	1 = yes, 0 = no
135	Geology G11	Enrollment in Geology in Grade 11	1 = yes, 0 = no
136	Geology G12	Enrollment in Geology in Grade 12	1 = yes, 0 = no
137	Adv Biol	Offering an Advanced Biology Course	1 = yes, 0 = no
138	Adv Biol Book	Use Advanced Biology Textbook(s)	1 = yes, 0 = no
139	Adv Biol G10	Enrollment in Advanced Biology in Grade 10	1 = yes, 0 = no
140	Adv Biol G11	Enrollment in Advanced Biology in Grade 11	1 = yes, 0 = no
141	Adv Biol G12	Enrollment in Advanced Biology in Grade 12	1 = yes, 0 = no
142	Adv Chem	Offering an Advanced Chemistry Course	1 = yes, 0 = no
143	Adv Phys	Offering an Advanced Physics Course	1 = yes, 0 = no
144	Honor	Offering an Honors Science Program	1 = yes, 0 = no

Environmental Education

145	EE	Teaching Environmental Education in School	1 = yes, 0 = no
146	EE G10	Teaching Environmental Ed Separately in Grade 10	1 = yes, 0 = no
147	EE W Sc G7	Teaching Environmental Ed with Science in Grade 7	1 = yes, 0 = no
148	EE W Sc G8	Teaching Environmental Ed with Science in Grade 8	1 = yes, 0 = no
149	EE W Sc G10	Teaching Environmental Ed with Science in Grade 10	1 = yes, 0 = no
150	EE W Sc G11	Teaching Environmental Ed with Science in Grade 11	1 = yes, 0 = no
151	Bel Av Stud	Offering Science for Below Average Students	1 = yes, 0 = no

VI. CHANGE

152	CHANGE	Opinion of Principal about having Major changes in School Science Programs Since 1971.	1 = yes, 0 = no

Major Changes in School Science Programs

153	Revis Cours	Revised Courses	1 = yes, 0 = no
154	Add Cours	Added Courses	1 = yes, 0 = no
155	Elim Cours	Eliminated Courses	1 = yes, 0 = no
156	Texts	Changed Textbooks	1 = yes, 0 = no
157	Local Mat	Developed new Material Locally	1 = yes, 0 = no
158	Red Req	Reduced Student Course Requirement	1 = yes, 0 = no
159	Inc Req	Increased Student Course Requirements	1 = yes, 0 = no
160	Satisfaction	Principal's Satisfaction with Current Science Programs.	5 = Very Satisfied 4 = Satisfied 3 = Neutral 2 = Dissatisfied 1 = Very Dissatisfied

TABLE 3.21

Names, Abbreviations and Coding for the Remaining Variables of the Teacher's Questionnaire for the Status of Science Teaching in Public Secondary Schools (Q:ST)

No.	Abbreviation	Name	Code
I.	TEACHER CHARACTERISTICS		
1	Age	Age of Teacher	1 = 20-29 2 = 30-39 3 = 40-49 4 = 50-59 5 = 60-69
2	Sex	Sex of Teacher	1 = M, 0 = F
3	Degree	Highest Degree held by Teacher	1 = BS or BA 2 = MS or MA 3 = PhD. or Ed.D
		Subject Matter Fields:	
4	Biol	Biology	2 = Major 3 = Minor 4 = Not Major or Minor
5	Chem	Chemistry	
6	Phys	Physics	
7	Phys Sc	Physical Science	
8	Earth Sc	Earth Science	
9	GS	General Science	
10	NSF Inser	Teacher Participation in NSF Inservice Activities	1 = yes, 0 = no
11	NSF CCSS	Cooperative College-School Science Program Prior 1974	1 = yes, 0 = no
12	NSF RPW	Resource Personnel Workshops Prior 1974	1 = yes, 0 = no
13	NSF CSC	Chautauqua Short Courses after 1974	1 = yes, 0 = no
14	NSF SSP	School System Projects after 1974	1 = yes, 0 = no
II.	TEACHING LOAD		
		Subjects or Courses and Class Size	
15	Teach Biol	Teaching Biology	1 = yes, 0 = no
16	Biol Class	Biology Average Class Size	Number
17	Teach Chem	Teaching Chemistry	1 = yes, 0 = no
18	Chem Class	Chemistry Average Class Size	Number
19	Teach Phys	Teaching Physics	1 = yes, 0 = no
20	Phys Class	Physics Average Class Size	Number
21	Teach Phys Sc	Teaching Physical Science	1 = yes, 0 = no
22	Phys Sc Class	Physical Science Class Size	Number
23	Teach Earth Sc	Teaching Earth Science	1 = yes, 0 = no
24	Earth Sc Class	Earth Science Average Class Size	Number
25	Teach GS	Teaching General Science	1 = yes, 0 = no
26	GS Class	General Science Average Class Size	Number
III.	SPECIAL SCIENCE FACILITIES:		
27	Auto Tut	Auto-tutorial Availability	1 = yes, 0 = no
28	CCTV	Closed-circuit Television Availability	1 = yes, 0 = no
29	CCTV Us	Closed-circuit Television Usage	3 = Often 2 = Occasionally 1 = Rarely
30	TV	Broadcast Television Availability	1 = yes, 0 = no
31	TV Us	Broadcast Television Usage	3 = Often 2 = Occasionally 1 = Rarely
32	Video	Videotape Recorder Availability	1 = yes, 0 = no
33	Video Us	Videotape Recorder Usage	3 = Often 2 = Occasionally 1 = Rarely
34	Radio	Ham Radio Station Availability	1 = yes, 0 = no

TABLE 3.21 (CONTINUED)

35	Radio Us	Ham Radio Station Usage	3 = Often 2 = Occasionally 1 = Rarely
36	Green H	Greenhouse Availability	1 = yes, 0 = no
37	Green H Us	Greenhouse Usage	3 = Often 2 = Occasionally 1 = Rarely
38	Land Lab	Land Laboratory Availability	1 = yes, 0 = no
39	Land Lab Us	Land Laboratory Usage	3 = Often 2 = Occasionally 1 = Rarely
40	Trail	Nature Trail(s) Availability	1 = yes, 0 = no
41	Observ	Observatory Availability	1 = yes, 0 = no
42	Observ Us	Observatory Usage	3 = Often 2 = Occasionally 1 = Rarely
43	Planet	Planetarium Availability	1 = yes, 0 = no
44	Planet Us	Planetarium Usage	3 = Often 2 = Occasionally 1 = Rarely
45	Dark R	Science Darkroom Availability	1 = yes, 0 = no
46	Dark R Us	Science Darkroom Usage	3 = Often 2 = Occasionally 1 = Rarely
47	Animal H	Ventilated Animal House Availability	1 = yes, 0 = no
48	Computers	Computer Availability	1 = yes, 0 = no
49	Weather S	Weather Station Availability	1 = yes, 0 = no
50	Weather S Us	Weather Station Usage	3 = Often 2 = Occasionally 1 = Rarely
51	Lab	Use of Laboratory or Special Room	1 = yes, 0 = no
52	Class	Use of Classroom with no Science Facilities	1 = yes, 0 = no
53	Class W Kit	Use of Classroom with Portable Science Kits	1 = yes, 0 = no

IV. SCIENCE TEACHING:

54	Text	Use of Single Textbook including Lab Manual	1 = yes, 0 = no
55	M Text Lab	Use of Multiple Textbooks including Lab Manual(s)	1 = yes, 0 = no
56	M Text	Use of Multiple Textbooks	1 = yes, 0 = no

V. COURSE OFFERINGS:

Biology

57	BSCS G	Use of BSCS Green	1 = yes, 0 = no
58	BSCS G G9	Enrollment in BSCS Green in Grade 9	1 = yes, 0 = no
59	BSCS G G10	Enrollment in BSCS Green in Grade 10	1 = yes, 0 = no
60	BSCS G G11	Enrollment in BSCS Green in Grade 11	1 = yes, 0 = no
61	BSCS G G12	Enrollment in BSCS Green in Grade 12	1 = yes, 0 = no
62	BSCS Y	Use of BSCS Yellow	1 = yes, 0 = no
63	BSCS Y G10	Enrollment in BSCS Yellow in Grade 10	1 = yes, 0 = no
64	BSCS Y G11	Enrollment in BSCS Yellow in Grade 11	1 = yes, 0 = no
65	BSCS B	Use of BSCS Blue	1 = yes, 0 = no
66	Oram	Use of Living Systems (Oram)	1 = yes, 0 = no
67	Oram G10	Enrollment in Oram in Grade 10	1 = yes, 0 = no
68	Oram G11	Enrollment in Oram in Grade 11	1 = yes, 0 = no
69	Oram G12	Enrollment in Oram in Grade 12	1 = yes, 0 = no
70	Smallwood	Use of Biology (Smallwood)	1 = yes, 0 = no
71	Smallwood G10	Enrollment of Smallwood in Grade 10	1 = yes, 0 = no
72	Smallwood G11	Enrollment of Smallwood in Grade 11	1 = yes, 0 = no
73	Smallwood G12	Enrollment of Smallwood in Grade 12	1 = yes, 0 = no
74	Heimler	Use of Focus on Life Science (Heimler)	1 = yes, 0 = no
75	Heimler G7	Enrollment of Heimler in Grade 7	1 = yes, 0 = no
76	Fitz	Use of Living Thing (Fitzpatrick)	1 = yes, 0 = no
77	Fitz G10	Enrollment of Fitzpatrick in Grade 10	1 = yes, 0 = no
78	Otto	Use of Biology (Otto)	1 = yes, 0 = no
79	Otto G9	Enrollment of Otto in Grade 9	1 = yes, 0 = no

TABLE 3.21 (CONTINUED)

80	Otto G10	Enrollment of Otto in Grade 10	1 = yes, 0 = no
81	Otto G11	Enrollment of Otto in Grade 11	1 = yes, 0 = no
82	Otto G12	Enrollment of Otto in Grade 12	1 = yes, 0 = no
	Chemistry		
83	Cotton	Use of Chemistry: An Investigative Approach (Cotton)	1 = yes, 0 = no
84	Cotton G11	Enrollment of Cotton in Grade 11	1 = yes, 0 = no
85	Cotton G12	Enrollment of Cotton in Grade 12	1 = yes, 0 = no
86	CHEMS	Use of CHEMS	1 = yes, 0 = no
87	CHEMS G10	Enrollment of CHEMS in Grade 10	1 = yes, 0 = no
88	CHEMS G11	Enrollment of CHEMS in Grade 11	1 = yes, 0 = no
89	CHEMS G12	Enrollment of CHEMS in Grade 12	1 = yes, 0 = no
90	Metcalfe	Use of Modern Chemistry (Metcalfe)	1 = yes, 0 = no
91	Metcalfe G10	Enrollment of Metcalfe in Grade 10	1 = yes, 0 = no
92	Metcalfe G11	Enrollment of Metcalfe in Grade 11	1 = yes, 0 = no
93	Metcalfe G12	Enrollment of Metcalfe in Grade 12	1 = yes, 0 = no
	Physics		
94	Williams	Use of Modern Physics (Williams)	1 = yes, 0 = no
95	Williams G11	Enrollment of Williams in Grade 11	1 = yes, 0 = no
96	Williams G12	Enrollment of Williams in Grade 12	1 = yes, 0 = no
97	PSSC	Use of PSSC	1 = yes, 0 = no
98	PSSC G11	Enrollment of PSSC in Grade 11	1 = yes, 0 = no
99	PSSC G12	Enrollment of PSSC in Grade 12	1 = yes, 0 = no
100	HPP	Use of Project Physics	1 = yes, 0 = no
101	HPP G11	Enrollment of Project Physics in Grade 11	1 = yes, 0 = no
102	HPP G12	Enrollment of Project Physics in Grade 12	1 = yes, 0 = no
	Physical Science		
103	IPS	Use of IPS	1 = yes, 0 = no
104	IPS G9	Enrollment of IPS in Grade 9	1 = yes, 0 = no
105	Tracy	Use of Modern Physical Science (Tracy)	1 = yes, 0 = no
106	Tracy G11	Enrollment of Tracy in Grade 11	1 = yes, 0 = no
	Earth Science		
107	Namowitz	Use of Earth Science (Namowitz)	1 = yes, 0 = no
108	Bishop	Use of Focus on Earth Science (Bishop)	1 = yes, 0 = no
109	ESCP	Use of ESCP	1 = yes, 0 = no
110	ESCP G9	Enrollment of ESCP in Grade 9	1 = yes, 0 = no
	Other Courses		
111	ISCS	Use of ISCS	1 = yes, 0 = no
	General Science		
112	GS	Offering a General Science Course	1 = yes, 0 = no
113	GS G9	Enrollment in General Science in Grade 9	1 = yes, 0 = no
114	GS G10	Enrollment in General Science in Grade 10	1 = yes, 0 = no
	Specialized Science Courses		
115	Spec Course	Offering Specialized Courses	1 = yes, 0 = no
116	Astro	Offering of an Astronomy Course	1 = yes, 0 = no
117	Astro Book	Use of Astronomy Textbook(s)	1 = yes, 0 = no
118	Astro G10	Enrollment of Astronomy in Grade 10	1 = yes, 0 = no
119	Astro G11	Enrollment of Astronomy in Grade 11	1 = yes, 0 = no
120	Astro G12	Enrollment of Astronomy in Grade 12	1 = yes, 0 = no
121	Physio	Offering of a Physiology Course	1 = yes, 0 = no
122	Physio Book	Use of Physiology Textbook(s)	1 = yes, 0 = no
123	Physio G10	Enrollment of Physiology in Grade 10	1 = yes, 0 = no
124	Physio G11	Enrollment of Physiology in Grade 11	1 = yes, 0 = no
125	Physio G12	Enrollment of Physiology in Grade 12	1 = yes, 0 = no
126	Zoology	Offering a Zoology Course	1 = yes, 0 = no
127	Botany	Offering a Botany Course	1 = yes, 0 = no
128	Botany Book	Use of Botany Textbook(s)	1 = yes, 0 = no
129	Botany G11	Enrollment of Botany in Grade 11	1 = yes, 0 = no
130	Ocean	Offering an Oceanography Course	1 = yes, 0 = no
131	Ocean Book	Use of Oceanography in Grade 11	1 = yes, 0 = no
132	Ocean G11	Enrollment of Oceanography in Grade 11	1 = yes, 0 = no
133	Ocean G12	Enrollment of Oceanography in Grade 12	1 = yes, 0 = no
134	Geology	Offering a Geology Course	1 = yes, 0 = no
135	Geology Book	Use of Geology Textbook(s)	1 = yes, 0 = no

TABLE 3.21 (CONTINUED)

136	Geology G10	Enrollment in Geology in Grade 10	1 = yes, 0 = no
137	Geology G11	Enrollment in Geology in Grade 11	1 = yes, 0 = no
138	Geology G12	Enrollment in Geology in Grade 12	1 = yes, 0 = no
139	Adv Biol	Offering an Advanced Biology Course	1 = yes, 0 = no
140	Adv Biol Book	Use of Advanced Biology Textbook(s)	1 = yes, 0 = no
141	Adv Biol G10	Enrollment in Advanced Biology in Grade 10	1 = yes, 0 = no
142	Adv Biol G11	Enrollment in Advanced Biology in Grade 11	1 = yes, 0 = no
143	Adv Biol G12	Enrollment in Advanced Biology in Grade 12	1 = yes, 0 = no
144	Adv Chem	Offering an Advanced Chemistry Course	1 = yes, 0 = no
145	Adv Phys	Offering an Advanced Physics Course	1 = yes, 0 = no
146	Honor	Offering an Honors Science Program	1 = yes, 0 = no
		Opinion of Teacher and the Need of Assistance in the Following Areas:	
147	Curr	Obtaining information about recent curriculum developments	1 = yes, 0 = no
148	Teach Meth	Obtaining information about new teaching methods	1 = yes, 0 = no
149	Instruct	Obtaining information about instructional materials	1 = yes, 0 = no
150	Subject	Obtaining information about subject matter	1 = yes, 0 = no
151	Resource	Obtaining information about out-of-school resources	1 = yes, 0 = no
152	Media	Obtaining information about films, TV and radio programs	1 = yes, 0 = no
153	Project	Implementing new curriculum projects	1 = yes, 0 = no
154	Local Mat	Developing local curriculum materials	1 = yes, 0 = no
155	Inquiry	Implementing discovery/inquiry approach	1 = yes, 0 = no
156	Articul	Articulating instruction across classrooms within a building and across different buildings	1 = yes, 0 = no
VI.	CHANGE		
157	Teach 70	Teaching 70/71 at the Same School	1 = yes, 0 = no
158	Change	Opinion of Teacher about having Major changes in Classroom Science Program Since 1971	1 = yes, 0 = no
		Major Changes in School Science Program	
159	Revised Cours	Revised Courses	1 = yes, 0 = no
160	Add Cours	Added Courses	1 = yes, 0 = no
161	Elim Cours	Eliminated Courses	1 = yes, 0 = no
162	Texts	Changed Textbooks	1 - yes, 0 = no
163	Local Mat	Developed New Material Locally	1 = yes, 0 = no
164	Red Req	Reduced Student Course Requirements	1 = yes, 0 = no
165	Inc Req	Increased Student Course Requirements	1 = yes, 0 = no
166	Satisfaction	Teacher's Satisfaction with Current Science Program.	5 = Very Satisfied 4 = Satisfied 3 = Neutral 2 = Dissatisfied 1 = Very Dissatisfied

TABLE 3.22

Names, Abbreviations and Coding for
the Remaining Variables of Principal and Teacher
Attitude Questionnaire (Q:AP & Q:AT)

No.	Abbreviation	Name	Code
	ID	Level	2 = Secondary
		Group	1 = Teacher, 2 = Principal
		Region	1 = GL, 2 = FW 3 = NE, 4 = ME 5 = SW, 6 = RM 7 = P, 8 = SE
		State	Number
		County	Number
		School	Number
		Respondent Number	Number
I.	DECISION MAKING		
1	Prin/Teach Inf	Influence Principal or Teacher has in determining Science Curriculum.	3 = Considerable 2 = Some 1 = None
		Influence each of the following groups or individuals has in determining science curriculum:	
2	State Dep Inf	State Department of Education	
3	Dist Sup Inf	District Superintendent	
4	Cent Staf Inf	Central Staff (Curriculum Coordinator or Supervisor)	
5	Sch Board Inf	School Board	
6	Prin Inf	Principal	
7	Dep Chair Inf	Department Chairman	
8	Teach Inf	Teachers	
9	Stud Inf	Students	
10	Parent Inf	Parents	
11	Prin/Teach Rol	Influence Principal or Teacher should have in determining Science Curriculum.	
		Influence each of the following groups or individuals should have in determining Science Curriculum:	
12	State Dep Rol	State Dep of Education	
13	Dist Sup Rol	District Superintendent	
14	Cent Staf Rol	Central Staff (Curriculum Coordinator or Supervisor)	
15	Sch Board Rol	School Board	
16	Prin Rol	Principal	
17	Dep Chair Rol	Department Chairman	
18	Teach Rol	Teachers	
19	Stud Rol	Students	
20	Parent Rol	Parents	
II.	CHANGES IN SCIENCE CURRICULUM AND INSTRUCTION		
21	Prin/Teach Chang	Attitude of Principal or Teacher toward introducing new Practices and Materials.	5 = Very Positive 4 = Positive 3 = Neutral 2 = Negative 1 = Very Negative
		Attitude of each of the following groups or individuals toward introducing new Practices and Materials.	
22	State Dep Chang	State Dep of Education	
23	Dis Sup Chang	District Superintendent	
24	Cent Staf Chang	Central Staff	
25	Sch Board Chang	School Board	
26	Prin Chang	Principal	
27	Dep Chair Chang	Department Chairman	
28	Teach Chang	Teachers	
29	Stud Chang	Students	
30	Parent Chang	Parents	

III. RESOURCES

TABLE 3.22 (CONTINUED)

		Opinion of principal or teacher of what should be spent on science programs compared to current spending	
31	Local Fund	Local Fund	5 = Much More 4 = More 3 = Same 2 = Less 1 = Much Less
32	Stat Fund	State Funds	
33	Fed Fund	Federal Funds	
34	Sci Eq	Opinion of Principal or Teacher of needed Science Equipment and Supplies	3 = Much More 2 = Somewhat More 1 = No More
		Opinion of Principal or Teacher of the degree of usefulness of information about new materials from each of the following:	
		A. Person-to-Person Communications	3 = Very Useful 2 = Useful 1 = Not Useful
35	PPC1	Teachers in Building	
36	PPC2	Principal of Building	
37	PPC3	Teachers within School District	
38	PPC4	Principals within School District	
39	PPC5	Curriculum Specialists within School District	
40	PPC6	Other Professionals with School District	
41	PPC7	Teachers outside School District	
42	PPC8	Principals outside District	
43	PPC9	State Department Personnel	
44	PPC10	Curriculum Specialist not from State Department	
45	PPC11	Textbook sales representatives	
46	PPC12	College professors	
47	PPC13	Science project developers	
		B. Printed Communication	
48	Period	Professional Periodicals	
49	Book	Textbooks	
50	Bullet	Bulletins and Newsletters	
		C. Formal Courses and Inservice Education	
51	Regul Cours	Regular College Courses	
52	Spec Cours	Special College Courses	
53	Local Ins	Local Inservice Programs	
54	Count Ins	County Inservice Programs	
55	Stat Ins	State Inservice Programs	
56	NSF Ins	NSF Inservice Programs	
		D. Mass Media	
57	Publ TV	Public TV	
58	Comm TV	Commercial TV	
59	Publ Radio	Public Radio	
60	Comm Radio	Commercial Radio	
61	Newsp	Newspapers	
62	Magaz	General Magazines	
		E. Meeting of Professional Organizations	
63	Local Org	Local Organizations Meetings	
64	Stat Org	State Organizations Meetings	
65	Nat Org	National Organizations Meetings	
		Opinion of principal or teacher of the degree of usefulness of the following types of information:	
66	Curr U	Curriculum	3 = Very Useful 2 = Useful 1 = Not Useful
67	Curr U1	NSF Materials	
68	Curr U2	State Curriculum Guides	
69	Curr U3	Locally Developed Materials	
70	Curr U4	Implementation Strategies	
71	Curr U5	Supplementary Activities	
72	Curr U6	Philosophy of Curriculum	

TABLE 3.22 (Continued)

73	Inst U	Instruction	
74	Inst U1	Teaching Techniques	
75	Inst U2	Laboratory Techniques	
76	Inst U3	Individualized Instruction	
77	Inst U4	Televised Instruction	
78	Inst U5	Audiovisual Instruction	
79	Clas U	Classroom Management	
80	Clas U1	Students' Behavior	
81	Clas U2	Classroom Management	
82	Eval U	Evaluation Methodology	
83	Polic U	Policies and Regulations	
84	Budg U	Budget and Expenditures	
85	Court U	Court and Judicial Decisions	
		Opinion of Principal or Teacher about how soon the following types of information are needed:	
86	Curr T	Curriculum	4 = Within 48 hours 3 = Within a week 2 = Within one month 1 = Within six months
87	Curr T1	NSF Materials	
88	Curr T2	State Curriculum Guides	
89	Curr T3	Local Developed Materials	
90	Curr T4	Implementation Strategies	
91	Curr T5	Supplementary activities	
92	Curr T6	Philosophy of Curriculum	
93	Inst T	Instruction	
94	Inst T1	Teaching Techniques	
95	Inst T2	Laboratory Techniques	
96	Inst T3	Individualized Instruction	
97	Inst T4	Televised Instruction	
98	Inst T5	Audiovisual Instruction	
99	Clas T	Classroom Management	
100	Clas T1	Students' Behavior	
101	Clas T2	Classroom Management	
102	Eval T	Evaluation Methodology	
103	Polic T	Policies and Regulations	
104	Budg T	Budget and Expenditures	
105	Court T	Court and Judicial Decisions	
IV.	FEDERAL SUPPORT FOR CURRICULUM DEVELOPMENT		
		Degree of Agreement with each of the following statements about Federal Support for Science Course Improvement.	5 = Strongly Agree 4 = Agree 3 = Neutral 2 = Disagree 1 = Strongly Disagree
106	Fed Sup1	Federal Support has improved the quality of curriculum alternatives	
107	Fed Sup2	Federal Support has improved the quality of classroom instruction	
108	Fed Sup3	Federal Government should direct attention toward disseminating materials	
109	Fed Sup4	Federal Support for the development of materials is probably unnecessary	
110	Fed Sup5	Federal Support tends to create a nationally uniform curriculum	
111	Fed Sup6	NSF should sponsor programs for implementing NSF materials	
112	Fed Sup7	NSF should sponsor programs for implementing Non-NSF materials	
113	Fed Sup8	Federal funds should be provided for the purchase of lab equipment	
		Opinion of Principal or Researcher about:	
114	Know NSF	Knowledge of recent Reduction of NSF Funds	1 = yes, 0 = no
115	EFF NSF	Effect of reducing NSF Funds on Science Curricula	5 = Very Positive 4 = Positive 3 = Neutral 2 = Negative 1 = Very Negative

TABLE 3.22 (Continued)

V. SCIENCE PROGRAMS

The Degree of Importance of the following for the Secondary School Science Program.

116	Obj 1	Factual Knowledge	3 = Very Important 2 = Important 1 = Not Important
117	Obj 2	Processes of Science	
118	Obj 3	Interaction of Science and Society	
119	Obj 4	Interaction of Science and Technology	
120	Obj 5	Values and Ethics of Science	
121	Obj 6	Appreciation of Human Endeavor	
122	Obj 7	Attitudes	
123	Obj 8	Science and Humanities	
124	Obj 9	Career	
125	Obj 10	Skills	
126	Obj 11	Nature and Science	
127	Obj 12	Self and Environment	

VI. BARRIERS TO CHANGE

Principal or Teacher Ranking of each of the following as a barrier to change:

128	Chang B1	Lack of Inservice Opportunities	3 = Serious Problem 2 = Somewhat of a Problem 1 = Not a Significant Problem
129	Chang B2	Lack of Consultant Services	
130	Chang B3	Inadequate Facilities	
131	Chang B4	Lack of Science Equipment	
132	Chang B5	Lack of Individualized Materials	
133	Chang B6	Insufficient Budget	
134	Chang B7	Costs of Curriculum Materials	
135	Chang B8	Out-Of-State Materials	
136	Chang B9	No Agreement about Curriculum	
137	Chang B10	Low priority of Science	
138	Chang B11	Inadequate Reading Ability	
139	Chang B12	Inadequate Math Background	
140	Chang B13	Low Enrollment	
141	Chang B14	Inadequate Articulation Within a Building	
142	Chang B15	Inadequate Articulation Within a District	
143	Chang B16	Teachers Inadequately Prepared	
144	Chang B17	Lack of Teacher Planning	
145	Chang B18	Lack of Interest	
146	Chang B19	Lack of Federal Support	
147	Chang B20	Lack of State Support	
148	Chang B21	Lack of Local Support	
149	Chang B22	Lack of Administrative Support	
150	Chang B23	Lack of Community Support	
151	Chang B24	Lack of Staff Support	
152	Chang B25	State Regulations	
153	Chang B26	Federal Regulations	
154	Chang B27	Lack of Communication	
155	Chang B28	Lack of Consultants	
156	Chang B29	Lack of Tangible Incentives	
157	Chang B30	Lack of Intangible Incentives	
158	Chang B31	Emphasis on Basic Skills	
159	Chang B32	Lack of Laboratory Assistants	

Principal or Teacher Ranking of the Following Tangible Incentives:

160	Tan Inc1	Extra Pay	3 = First Most Important 2 = Second Most Important 1 = Third Most Important 0 = Not Used
161	Tan Inc2	Salary Differential	
162	Tan Inc3	Released Time	
163	Tan Inc4	Travel Funds	

Principal or Teacher Ranking of the Following Intangible Incentives:

164	Int Inc1	Intrinsic Satisfaction	
165	Int Inc2	Development of Group Affiliation	
166	Int Inc3	Increase Sense of Influence	
167	Sci Mat	Opinion of Teacher or Principal about the Use of Parts of a textbook with other supplementary Materials	1 = yes, 0 = no

TABLE 3.22 (Continued)

CAST

Principal or Teacher Ranking of the type of activity that takes place in science classroom with regard of the following:

168	CAST 1	Students activities that take place
169	CAST 2	Student activities that should take place
170	CAST 3	Teacher role that takes place
171	CAST 4	Teacher role that should take place
172	CAST 5	Use of textbook that takes place
173	CAST 6	Use of textbook that should take place
174	CAST 7	Use of tests that takes place
175	CAST 8	Use of tests that should take place
176	CAST 9	Lab activities that takes place
177	CAST 10	Lab activities that should take place

5 = Very Important
to
1 = Not Important

CHAPTER IV

RESULTS AND DISCUSSION

This chapter presents the results of the data collected in both descriptive and tabular form. Two major sections are included. In the first section, descriptive data, are presented dealing with:

(1) Current status of science teaching during the 1979/80 school year in the selected sample of public secondary schools (Grades 7-12). The data were obtained by administering the Principal's Survey Questionnaire (Q:SP) and the Teacher's Survey Questionnaire (Q:ST).

(2) Principals' and science teachers' attitudes toward change in science curricula and school practices. The data were obtained by administering the Principal's Attitude Questionnaire (Q:AP) and the Teacher's Attitude Questionnaire (Q:AT).

(3) The perception of principals and science teachers of science classroom activities. The data were obtained by administering the checklist for Assessment of Science Teacher (Principal's Perception) (CAST:PP) and the checklist for Assessment of Science Teacher (Teacher's Perception) (CAST:TP).

The second section deals with:

(1) Changes that have occurred in science curricula and school practices in the selected schools from 1970/71 to 1979/80 school years. Data from this study of 1979/80 were compared with those of the OSU study of 1970/71.

Descriptive data presented deal with:

(a) common variables used in both of the two principal's survey questionnaires of 1970/71 and 1979/80; and

(b) change variables between 1979/80 and 1970/71.

The significance of the change variables using a series of t-tests is also discussed.

(2) Relationship between change in science curricula and school practices, and state control of education. Data were analyzed by using Analysis of Variance and Scattergram.

SECTION I

STATUS OF SCIENCE TEACHING IN PUBLIC SECONDARY SCHOOLS AND ATTITUDES OF PRINCIPALS AND TEACHERS TOWARD CHANGE DURING THE 1979/80 SCHOOL YEAR

The results and discussion in this section are organized under the following headings:

1. The Principal's Questionnaire
2. The Science Teacher's Questionnaire
3. Attitudes toward science curriculum and instruction
4. Assessment of science teachers

THE PRINCIPAL'S QUESTIONAIRE (Q:SP)

The principals of the sample schools were requested to respond to the principal's questionaire to provide summative data for all the science teachers, science budget and science programs in the school. The principal's questionaire includes five parts.

The first part presents the school organization. Included are the school grade levels, student enrollment by grade level, trend in the science enrollment over the past three years (1977-79) and required science courses.

The second part presents some information about the previous experience of the principals and the number of years they have been working as principals.

The third part presents the science teachers. This includes their teaching assignment.

The fourth part presents the science budget for science equipment, science supplies and science curriculum materials. Included are the types of action which have been taken in the sample schools as a result of school budget cuts.

The fifth part presents the science course offerings. This includes all the science courses or textbooks that were used in the schools in the sample during the 1979/80 school year. Included also are the titles of the science courses or textbooks, grade level of students, curriculum materials and major textbooks used with publication date, environmental/conservation education programs taught by grade level, and science courses for below average students and for gifted students.

School Organization

One hundred public secondary schools were sampled for this study. The sampled schools were selected randomly from 10 states (10 schools from each state). The states were selected from the eight regions of the USA which were used in the 1970/71 OSU study. Data were received from 97 secondary schools; this represents 97 percent of the selected schools. Table 4.1 presents the number and percent of participated schools in each region.

TABLE 4.1

FREQUENCY DISTRIBUTION OF THE SAMPLE OF PUBLIC SECONDARY SCHOOLS BY REGIONS

Region	Number	Percent
Great Lakes	10	10.3
Farwest	9	9.3
New England	9	9.3
Mid-East	10	10.3
Southwest	10	10.3
Rocky Mountains	10	10.3
Plains	20	20.6
Southeast	19	19.6
Total	97	100.0

Types of Schools

The selection of the sampled schools was delimited to three types of schools: (1) schools with grades 7-9; (2) schools with grades 9-12; and (3) schools with grades 10-12. Table 4.2 presents data regarding the types of schools in the sample. Of the 97 secondary schools 44.3 percent were four-year high schools (grades 9-12), while 29.9 percent were three-year high schools (grades 10-12). Junior high schools (grades 7-9) accounted for 25.8 percent of the total.

TABLE 4.2

FREQUENCY DISTRIBUTION OF THE SAMPLE OF PUBLIC SECONDARY SCHOOLS BY TYPE OF SCHOOL ORGANIZATION

Type of school by grades	Number	Percent
7-9	25	25.8
9-12	43	44.3
10-12	29	29.9
Total	97	100.0

Student Enrollment

Student enrollments in grades seven through twelve are shown in Tables 4.3 through 4.8. Seventy-two schools were high schools and had no seventh grade or eighth grade (with zero enrollment on Tables 4.3 and 4.4). Twenty-nine schools had no ninth grade (with zero enrollment on Table 4.5). Twenty-five schools were junior high schools and had no tenth, eleventh or twelfth grades (with zero enrollment on Tables 4.6, 4.7 and 4.8).

TABLE 4.3

FREQUENCY DISTRIBUTION OF SEVENTH GRADE STUDENT ENROLLMENTS BY SCHOOL

Student enrollments	Number	Percent
0 (No Grade 7)	72	74.3
99 or less	1	1.0
100-199	4	4.1
200-299	12	12.4
300-399	2	2.1
400-499	3	3.1
500-599	1	1.0
600-699	1	1.0
700-799	1	1.0
Total	97	100.0

Mean enrollment in schools with seventh grade (N = 25) = 306

TABLE 4.4

FREQUENCY DISTRIBUTION OF EIGHTH GRADE STUDENT ENROLLMENTS BY SCHOOL

Student enrollments	Number	Percent
0 (No Grade 8)	72	74.2
99 or less	1	1.0
100-199	3	3.1
200-299	12	12.4
300-399	2	2.1
400-499	6	6.2
500-699	1	1.0
700-799	0	0.0
Total	97	100.0

Mean enrollment in schools with eighth grade (N = 25) = 301

TABLE 4.5

FREQUENCY DISTRIBUTION OF NINTH GRADE STUDENT ENROLLMENTS BY SCHOOL

Student enrollments	Number	Percent
0 (No Grade 9)	29	29.9
99 or less	2	2.1
100-199	12	12.4
200-299	19	19.6
300-399	16	16.5
400-499	10	10.3
500-599	4	4.1
600-699	4	4.1
700-799	1	1.0
Total	97	100.0

Mean enrollment in schools with ninth grade (N = 68) = 331

TABLE 4.6

FREQUENCY DISTRIBUTION OF TENTH GRADE STUDENT ENROLLMENTS BY SCHOOL

Student enrollments	Number	Percent
0 (No Grade 10)	25	25.8
99 or less	1	1.0
100-199	10	10.3
200-299	14	14.4
300-399	19	19.6
400-499	6	6.2
500-599	8	8.2
600-699	6	6.2
700-799	4	4.1
800-899	2	2.1
900- up	2	2.1
Total	97	100.0

Mean enrollment in schools with tenth grade (N = 72) = 410

TABLE 4.7

FREQUENCY DISTRIBUTION OF ELEVENTH GRADE STUDENT ENROLLMENTS BY SCHOOL

Student enrollments	Number	Percent
0 (No Grade 11)	25	25.8
99 or less	2	2.1
100-199	13	13.4
200-299	16	16.5
300-399	14	14.4
400-499	8	8.2
500-599	9	9.3
600-699	5	5.1
700-799	2	2.1
800-899	2	2.1
900- up	1	1.0
Total	97	100.0

Mean enrollment in schools with eleventh grade (N = 72) = 372

TABLE 4.8

FREQUENCY DISTRIBUTION OF TWELFTH GRADE STUDENT ENROLLMENTS BY SCHOOL

Student enrollments	Number	Percent
0 (No Grade 12)	25	25.8
99 or less	3	3.1
100-199	13	13.4
200-299	24	24.8
300-399	8	8.2
400-499	7	7.2
500-599	10	10.3
600-699	3	3.1
700-799	3	3.1
800-899	1	1.0
900- up	0	0.0
Total	97	100.0

Mean enrollment in schools with twelfth grade (N = 72) = 339

Total Enrollment

Schools were divided by total enrollment into seven basic groups. Sampled schools were delimited to secondary schools with enrollments of more than 300 students. Schools with student populations of 301 to 499 accounted for 6.2 percent of the sample schools. Schools with from 500 to 999 students represented 35.0 percent. Schools with 1000 to 1499 students accounted to 30.9 percent. Schools with 1500 to 1999 students accounted for 16.5 percent. Schools with 2000 to 2499 accounted for 9.3 percent. Schools with 2500 or more students made 2.1 percent of the sample. (Table 4.9).

The sample schools in this study represented 119,622 public secondary students. The mean enrollment in the sample schools was 1233.

TABLE 4.9

FREQUENCY DISTRIBUTION OF SCHOOL SIZE BASED ON TOTAL STUDENT ENROLLMENT BY SCHOOL

Total enrollment	Number of schools	Percent of schools
300 or less	0	0.0
301 - 499	6	6.2
500 - 999	34	35.0
1000 - 1499	30	30.9
1500 - 1999	16	16.5
2000 - 2499	9	9.3
2500 - up	2	2.1
Total	97	100.0

Total students = 119,622

Mean enrollment in the sample schools = 1233

Science Enrollment

The trend in the science enrollment over the past three years (1977-79) was reported by the principals of the participating schools. Data on Table 4.10 indicate that 19.8 percent of the principals reported an increase in the number of students enrolled in science courses, while 23.9 percent reported a decrease in the number of students enrolled in science courses. About 56 percent of the principals reported no significant change.

TABLE 4.10

FREQUENCY DISTRIBUTION OF THE TREND IN THE NUMBER OF STUDENTS ENROLLED IN SCIENCE COURSES OVER THE PAST THREE YEARS (1977-79) BY SCHOOL

Trend	Number of schools	Percent of schools
Increase in number of students	19	19.8
No significant change	54	56.3
Decrease	23	23.9
Total	96	100.0

Data on Table 4.11 indicate that 20.0 percent of principals reported an increase in the percentage of students enrolled in science courses with regard to the school enrollment over the past three years (1977-79). Only 9.5 percent of the principals reported a decrease in the percentage of students enrolled in science courses.

Approximately 71.0 percent of the principals reported no significant change.

TABLE 4.11

FREQUENCY DISTRIBUTION OF THE TREND IN THE PERCENTAGE OF STUDENTS ENROLLMENT IN SCIENCE COURSES WITH REGARD TO THE SCHOOL ENROLLMENT OVER THE PAST THREE YEARS (1977-79) BY SCHOOL.

Trend	Number of schools	Percent of schools
Increase in percentage	19	20.0
No significant change	67	70.5
Decrease	9	9.5
Total	95	100.0

Required Science Courses

Each principal was asked to specify whether specific science courses were required for students in his or her school. Data on Table 4.12 show that 84 percent of the junior high schools (Grades 7-9) required specific science courses. Approximately 49 percent of high schools (Grades 9-12) required specific science courses; only 31 percent of high schools (Grades 10-12) required specific science courses.

TABLE 4.12

FREQUENCY OF THE SCHOOLS HAVING SPECIFIC REQUIRED SCIENCE COURSES BY TYPE OF SCHOOL

Type of school	Yes		No		Total	
	Number of schools	Percent of schools	Number of schools	Percent of schools	Number of schools	Percent of school
Junior High School (Grades 7-9)	21	84.0	4	16.0	25	100.0
High Schools (Grades 9-12)	21	48.8	22	51.2	43	100.0
High Schools (Grades 10-12)	9	31.0	20	69.0	29	100.0
Total	51	52.6	46	47.4	97	100.0

Generally, for the total sample schools (Grades 7-12) approximately 53 percent required specific science courses. Principals who reported that their schools required specific science courses were requested to specify names of their required science courses.

Table 4.13 presents the science courses required in junior high schools (Grades 7-9). The percentages of the schools requiring courses are presented with regard to the total number of the junior high schools that required specific science courses. Data show that the most frequent required science courses were life science or biology courses (33.3 percent). Earth science courses were the second most frequent (28.3 percent) and physical science courses were the third most frequent (26.8 percent) required courses. The percentage requiring general science was very low. With respect to the required life science, or biology courses for junior high schools the majority of these courses were life science courses (85 percent); few were biology courses (15 percent).

TABLE 4.13
FREQUENCY OF THE SCIENCE COURSES REQUIRED IN THE JUNIOR HIGH SCHOOL (GRADES 7-9) BY SCHOOL

Required science courses	Number of schools requiring courses	Percentage of schools requiring courses
Biology or Life Science	20	33.3
Chemistry	0	0.0
Physics	0	0.0
Physical Science	16	26.7
Earth Science	17	28.3
General Science	5	8.3
Others	2	3.3
Total	60	100.0

Table 4.14 presents the science courses required in high schools. Both the two types of high schools (Grades 9-12) and (Grades 10-12) are lumped together and treated as one type of school. The percentages of the schools requiring science courses are presented with regard to the total number of the high schools that required specific science courses. Data show that the most frequent required science courses were biology or life science courses (about 49 percent). The percentage of other required science courses was very low. Earth science and general science courses were the second most required science courses (about 11 percent). Physical science and chemistry courses were the third most required science courses (about 7 percent). The percentage of required physics courses was very low (5.5 percent). Other science courses were also required which represented about 9 percent of the total number of required courses. Such these courses were introductory science, frosh science, basic science and comprehensive science.

TABLE 4.14

FREQUENCY OF THE SCIENCE COURSES REQUIRED IN THE HIGH SCHOOL (GRADES 9-12 OR GRADES 10-12) BY SCHOOL

Required science courses	Number of schools requiring courses	Percentage of schools requiring courses
Biology of Life Science	27	49.1
Chemistry	4	7.2
Physics	3	5.5
Physical Science	4	7.3
Earth Science	6	10.9
General Science	6	10.9
Others	5	9.1
Total	55	100.0

Principals of Participating Schools

This part presents information about the principals of the participating schools. Each principal was asked to indicate whether he or she was working during the 1970-71 school year at the same school. Data on Table 4.15, show that approximately 63 percent of principals were working during the 1970-71 school year at the same school. Table 4.16 indicates that of these principals who responded and were working during the 1970-71 school year at the same school approximately 89 percent were working as administrators. The data, presented in Table 4.17, show that of those principals who were working during the 1970-71 school year at the same school only 1.6 percent were working as teachers at the same school.

TABLE 4.15

FREQUENCY DISTRIBUTION OF PRINCIPALS WHO WERE WORKING DURING THE 1970-71 SCHOOL YEAR AT THE SAME SCHOOL BY SCHOOL

Working in 70/71 at same school	Number of schools	Percent of schools
Yes	61	62.9
No	36	37.1
Total	97	100.0

TABLE 4.16

FREQUENCY DISTRIBUTION OF PRINCIPALS WHO WERE WORKING DURING THE 1970-71 SCHOOL YEAR AT THE SAME SCHOOL AS ADMINISTRATORS BY SCHOOL

Working as principal	Number of principals	Percent of principals
Yes	54	88.5
No	7	11.5
Total	61	100.0

TABLE 4.17

FREQUENCY DISTRIBUTION OF PRINCIPALS WHO WERE WORKING DURING THE 1970-71 SCHOOL YEAR AT THE SAME SCHOOL AS TEACHERS BY SCHOOL

Working as teacher	Number of principals	Percent of principals
Yes	1	1.6
No	60	98.4
Total	61	100.0

Principals were asked about the number of years each had worked as principal in the same school (1979/80 was counted as one year). Table 4.18 shows that principals who had worked for one to four years represented 39 percent of the sample. Principals who had worked for five to nine years accounted for 23.1 percent. Principals with 10 to 14 years experience represented 26.3 percent. Only 11.6 percent of the principals had been at the same school for more than 15 years. The mean was 7.5 years.

TABLE 4.18

FREQUENCY DISTRIBUTION OF THE NUMBER OF YEARS EACH PRINCIPAL HAD WORKED IN THE SAME SCHOOL AS PRINCIPAL BY PRINCIPAL

Number of years	Number of principals	Percent of principals
1-4	37	39.0
5-9	22	23.1
10-14	25	26.3
15- up	11	11.6
Total	95	100.0
Mean		7.5

Science Teachers

Principals were asked to specify the number of regularly employed teachers who were teaching at least one science subject or course (this includes such courses as electronics, space science, oceanography and photography as well as biology, chemistry, physics, earth science, general science, and physical science). Data on Table

4.19 shows the number and percentage of male science teachers in the sampled schools. Approximately 43 percent of schools had from one to four male science teachers while 41.7 percent had from five to nine male science teachers. Only 14.6 percent had from 10 to 14 male science teachers. The mean was 5.6 teachers.

TABLE 4.19

FREQUENCY DISTRIBUTION OF MALE SCIENCE TEACHERS BY SCHOOL

Number of Male science teachers	Number of schools	Percent of schools
0	1	1.0
1-4	41	42.7
5-9	40	41.7
10-14	14	14.6
15- up	0	0.0
Total	96	100.0
Mean		5.6

Table 4.20 presents the number and percentage of female science teachers in the sample schools. Approximately 18 percent of the schools had no female science teachers while 68.7 percent of the schools had from one to four female science teachers. Only 9.4 percent of the analyzed schools had from five to nine female science teachers. The mean was 2.0 female teachers per school.

TABLE 4.20

FREQUENCY DISTRIBUTION OF FEMALE SCIENCE TEACHERS BY SCHOOL

Number of female science teachers	Number of schools	Percent of schools
0	17	17.8
1-4	66	68.7
5-9	9	9.4
10- up	0	0.0
Total	96	100.0
Mean		2.0

Percentage of Time Assigned to Teaching Science

Science teaching assignments are shown in Table 4.21. The percentage of science teaching was reported in five equal intervals. Most science teachers were teaching science 80 to 100 percent of the time.

TABLE 4.21

FREQUENCY DISTRIBUTION OF TEACHERS WITH VARYING ASSIGNMENTS DEVOTED TO SCIENCE TEACHING BY REGIONS

Percent of assignment in science and number of teachers 0-20%	Number of schools	Percent of schools
0	72	75.0
1-4	24	25.0
5-9	0	0.0
Total	96	100.0
21-40%	Number of schools	Percent of schools
0	73	76.0
1-4	23	24.0
5-9	0	0.0
Total	96	100.0
41-60%	Number of schools	Percent of schools
0	75	78.1
1-4	21	21.9
5-9	0	0.0
Total	96	100.0

TABLE 4.21 (CONTINUED)

61-80%	Number of schools	Percent of schools
0	79	82.3
1-4	16	16.7
5-9	1	1.0
Totals	96	100.0

81-100%	Number of schools	Percent of schools
0	2	2.1
1-4	31	32.3
5-9	47	49.0
10-14	13	13.5
15- up	3	3.1
Totals	96	100.0

Financial Support For Science Instruction

Science Budget

Table 4.22 presents data regarding regular annual budgets for science equipment. Of the sample schools 69.1 percent reported a budget for science equipment.

TABLE 4.22

FREQUENCY OF SCHOOLS HAVING ANNUAL BUDGETS FOR NEW SCIENCE EQUIPMENT BY SCHOOL

Have equipment budget	Number of schools	Percent of schools
Yes	67	69.1
No	30	30.9
Total	97	100.0

The amount of money for science equipment budgeted per student for 1979-80 school year was reported by 64.2 percent of these schools that had an annual budget for science equipment. Data on Table 4.32 show that the range for the budget for science equipment was from $1.00 to $20.00 per student for 1979-80 school year. The mean was about $3.93 per student.

TABLE 4.23

AMOUNT OF SCIENCE EQUIPMENT BUDGETED PER STUDENT FOR THE 1979/80 SCHOOL YEAR BY SCHOOL

Budget for equipment per student in dollars	Number of schools	Percent of schools
1.00	15	34.9
2.00	11	25.6
3.00	2	4.7
4.00	5	11.6
5.00	2	4.7
8.00	1	2.3
10.00	4	9.3
13.00	1	2.3
15.00	1	2.3
20.00	1	2.3
Total	43	100.0

Mean of schools that had budgets = $3.93 per student

Data on Table 4.24 shows that approximately 89 percent of the schools had annual budgets for science supplies.

TABLE 4.24

FREQUENCY OF SCHOOLS HAVING ANNUAL BUDGETS FOR SCIENCE SUPPLIES BY SCHOOL

Have supplies budget	Number of schools	Percent of schools
Yes	86	88.7
No	11	11.3
Total	97	100.0

The amount of money budgeted for science supplies per student for 1979-80 school year was reported by 72.1 percent of these schools that had annual budgets for the purchase of supplies. Data on Table 4.25 show that the range for the budget for purchasing supplies was from $1.00 to $28.00 per student for 1979-80 school year. The mean was about $4.66 per student.

TABLE 4.25

AMOUNT OF SCIENCE SUPPLIES BUDGETED PER STUDENT FOR THE 1979/80 SCHOOL YEAR BY SCHOOL

Budget for supplies per student	Number of schools	Percent of schools
1.00	14	22.6
2.00	11	17.7
3.00	12	19.4
4.00	7	11.3
5.00	4	6.5
6.00	3	4.8
7.00	1	1.6
8.00	1	1.6
10.00	2	3.2
11.00	3	4.8
13.00	1	1.6
20.00	1	1.6
22.00	1	1.6
28.00	1	1.6
Total	62	100.0

Mean of schools that had budgets = $4.66 per student

Buying equipment and supplies during the school year has frequently been reported as a problem for science teachers. Data on Table 4.26 show that approximately 87 percent of the schools had funds available for this purpose.

TABLE 4.26

FREQUENCY OF SCHOOLS ALLOWING PURCHASE OF EQUIPMENT AND SUPPLIES DURING SCHOOL YEAR BY SCHOOL

Having funds available	Number of schools	Percent of schools
Yes	84	86.6
No	13	13.4
Total	97	100.0

Textbook Budget

Principals were asked to indicate if their schools had an annual budget for the purchase of textbooks, and, if so, to specify the amount of this budget for the 1979-80 school year. Table 4.27 shows that 76 percent of the schools had an annual budget for the purchase of science textbooks. Data on Table 4.28 indicates the amount per student for science textbook purchase for the 1979-80 school year. The per student amounts of these budgets ranged from one dollar to 22 dollars. The mean was $7.29 per student.

TABLE 4.27

FREQUENCY OF SCHOOLS HAVING ANNUAL BUDGETS FOR THE PURCHASE OF TEXTBOOKS BY SCHOOLS

Have budget	Number of schools	Percent of schools
Yes	73	76.0
No	23	24.0
Total	96	100.0

TABLE 4.28

AMOUNT OF MONEY BUDGETED FOR SCIENCE TEXTBOOKS PER STUDENT FOR 1979/80

Book budget per student in dollars	Number of schools	Percent of schools
1.00	8	17.8
2.00	8	17.8
3.00	5	11.1
4.00	2	4.4
6.00	1	2.2
7.00	1	2.2
8.00	1	2.2
9.00	1	2.2
10.00	5	11.1
11.00	2	4.4
12.00	2	4.4
13.00	2	4.4
14.00	1	2.2
15.00	1	2.2
16.00	1	2.2
20.00	2	4.4
22.00	2	4.4
Total	45	100.0

Mean of schools with budgets = $7.29 per student

Budget Cuts

Principals were asked to indicate whether they have had budget cuts in their schools that have affected the science curriculum and, if so, to specify specific actions taken as a result of budget cuts. Table 4.29 shows that 30.2 percent of the schools had budget cuts that have affected the science curriculum.

TABLE 4.29

FREQUENCY DISTRIBUTION OF SCHOOLS HAVING BUDGET CUTS THAT HAVE AFFECTED THE SCIENCE CURRICULUM BY SCHOOL

Budget cuts	Number of schools	Percent of schools
Yes	29	30.2
No	67	69.8
Total	96	100.0

Data on Table 4.30 show specific actions, taken as a result of budget cuts, that have affected the science curriculum. Devoting less money for instructional materials, increasing class size and reducing optional courses were the most common actions taken to face cuts in school budgets.

TABLE 4.30

FREQUENCY DISTRIBUTION OF SOME ACTIONS TAKEN AS A RESULT OF BUDGET CUTS BY SCHOOL

Action	Number of reporting schools	Percent of reporting schools
Increase in class size	10	27.0
More teaching from textbooks	6	16.2
Less money for instructional materials	25	67.6
Good teachers have left	1	2.7
Optional courses reduced	9	24.3
Inservice training	2	5.4
Teachers have been assigned to teach subjects for which they have little or no background	2	5.4

The Science Curriculum in Public Secondary Schools

One of the major purposes of this study was to determine what science was being taught in public secondary schools during the 1979/80 school year. A multiple table for commonly used textbooks or courses in science subjects areas was prepared as part of the survey questionaire. (See Appendix B). Each principal was asked to specify the textbooks or courses in his or her school during the 1979/80 school year. Table 4.31 presents the percentage of use of each book or course in each grade level (grade 7 through 12).

Biology or Life Science

An examination of data on Table 4.31, shows that biology or life science courses were offered in grades 7 through 12 during the 1979/80 school year. Data on Table 4.31, show that the most commonly used textbooks or courses in biology or life science during the 1979/80 school year were those listed below.

1. Modern Biology (Otto)

Data on Table 4.31 show that this biology textbook was used more heavily than any other biology or life science textbook. It was used in high schools at all grade levels. The percentage of grade level using Modern Biology of Otto was highest at grade 10 (47.2 percent of the schools with grade 10). The percentage decreased to 29.2 percent at grade 11 and to 25 percent at grade 12.

TABLE 4.31

PERCENTAGE OF TEXTBOOKS MOST FREQUENTLY USED IN SCIENCE COURSES DURING THE 1979-80 SCHOOL YEAR

Textbook or course	Grade levels					
	7	8	9	10	11	12
	N(25)	N(25)	N(68)	N(72)	N(72)	N(72)
Biology or Life Science						
1. Biological science: An ecological approach (BSCS Green).	4.0	0.0	13.2	19.4	13.9	11.1
2. Biological science: An inquiry into life (BSCS Yellow).	0.0	0.0	1.5	12.5	8.3	5.6
3. Biological science: Interaction of experiments and ideas (BSCS).	0.0	0.0	0.0	0.0	0.0	2.2
4. Biological science: Me and my environment.	0.0	0.0	0.0	0.0	0.0	0.0
5. Biological science: Molecules to man (BSCS Blue).	0.0	0.0	4.4	5.6	2.8	1.4
6. Biological science: Patterns and processes (BSCS).	0.0	0.0	0.0	1.4	0.0	0.0
7. Biology: Introduction to life (Nason).	0.0	0.0	0.0	0.0	1.4	0.0
8. Biology: Living systems (Oram).	0.0	4.0	4.4	12.5	8.3	6.9
9. Biology (Kroeber).	0.0	0.0	0.0	0.0	0.0	0.0
10. Biology (Smallwood).	0.0	0.0	5.9	15.3	9.7	6.9
11. Focus on life science (Heimler).	28.0	4.0	0.0	2.8	2.8	2.8
12. Human sciences program (BSCS).	0.0	0.0	0.0	0.0	0.0	1.4
13. Interaction of man and the biosphere: Inquiry in life science (Abraham).	12.0	0.0	0.0	0.0	0.0	0.0
14. Life in the environment (Navarra).	0.0	0.0	0.0	0.0	0.0	1.4
15. Life: Its forms and changes.	4.0	0.0	0.0	4.0	0.0	0.0
16. Living things (Fitzpatrick).	0.0	0.0	1.5	8.3	5.6	4.2
17. Modern biology (Otto).	4.0	4.0	19.1	47.2	29.2	25.0

TABLE 4.31 (CONTINUED)

Textbook or course	Grade levels 7 N(25)	 8 N(25)	 9 N(68)	 10 N(72)	 11 N(72)	 12 N(72)
Chemistry						
1. Chemistry: An experimental science (Primantel).	0.0	0.0	0.0	0.0	4.0	0.0
2. Chemistry: An investigative approach (Cotton).	0.0	0.0	0.0	2.8	8.3	6.9
3. Chemistry: Experiments and principles (CHEM study).	0.0	0.0	1.5	9.7	15.3	8.3
4. Chemistry (Sienko).	0.0	0.0	0.0	0.0	1.4	2.8
5. Interdisciplinary approach to chemistry (IAC).	0.0	0.0	0.0	1.4	4.2	1.4
6. Modern chemistry (Metcalfe).	0.0	0.0	2.9	16.7	33.3	23.6
Physics						
1. College physics (Schaum).	0.0	0.0	0.0	1.4	2.8	4.2
2. Modern physics (Williams).	0.0	4.0	1.5	1.4	22.2	30.6
3. PSSC physics (Haber-Schaim).	0.0	0.0	0.0	0.0	11.1	18.1
4. The project physics (Rutherford).	0.0	0.0	0.0	0.0	6.9	18.1
Physical Science						
1. Interaction of matter and energy: Inquiry in physical science (Abraham).	0.0	0.0	0.0	1.5	0.0	1.4
2. Introductory physical science (IPS) (Haber-Schaim).	0.0	12.0	14.7	4.2	2.8	1.4
3. Modern physical science (Tracy).	0.0	0.0	5.9	5.6	8.3	5.6
4. Physical science II (PS II) (Haber-Schaim).	0.0	0.0	2.9	0.0	0.0	1.4
5. The man made world (ECCP).	0.0	0.0	0.0	0.0	1.4	1.4

TABLE 4.31 (CONTINUED)

Textbook or course	Grade levels 7 N(25)	 8 N(25)	 9 N(68)	 10 N(72)	 11 N(72)	 12 N(72)
Earth Science						
1. Earth science: The world we live in (Namowitz).	8.0	8.0	11.8	1.4	1.4	0.0
2. Focus on earth science (Bishop).	0.0	24.0	4.4	4.2	2.8	1.4
3. Investigating the earth (ESCP).	0.0	8.0	7.4	4.2	2.8	0.0
4. Modern earth science (Ramsey).	4.0	4.0	0.0	1.4	4.2	2.8
5. Time, space and matter (TSM).	0.0	0.0	0.0	0.0	0.0	1.4
Other Courses or Textbooks						
1. Individualized science instructional system (ISIS) (Burkman).	0.0	0.0	1.5	1.4	1.4	1.4
2. Modern science series (Blanc).	0.0	0.0	1.5	0.0	0.0	0.0
3. Principles of science series (Heimler).	0.0	0.0	0.0	1.4	0.0	0.0
4. Probing the natural world (ISCS).	12.0	4.0	5.9	0.0	1.4	1.4
5. Study lessons in general science (Gross)	0.0	0.0	0.0	0.0	0.0	0.0

2. Biological Science: An Ecological Approach (BSCS Green)

Data on Table 4.31 show that BSCS Green Biology was used in all grades but grade 8. The materials were used most frequently in grade 10 (19.4 percent) and next most frequently in grades 11 (13.9 percent) and 9 (13.2 percent). The BSCS Green text was used more frequently than BSCS Yellow and BSCS Blue texts.

3. Biology (Smallwood)

Data on Table 4.31 show that this biology textbook was used in all grades but grades 7 and 8. The use of this book was highest at grade 10 (15.3 percent). The percentage decreased to approximately 10 percent at grade 11 and to 6.9 percent at grade 12. Approximately 6 percent of the schools used this book at grade 9.

4. Biological Science: An Inquiry into Life (BSCS Yellow)

Data on Table 4.31 show that BSCS Yellow Biology was used in grades 9 through 12. The use of BSCS Yellow was highest at grade 10 (12.5 percent). The percentage decreased to 8.3 percent at grade 11 and to approximately 6 percent at grade 12.

5. Biology: Living Systems (Oram)

Data on Table 4.31 show that this biology textbook was used in all grades but grade 7. The use was highest at grade 10 (12.5 percent). The percentage of use decreased gradually to 8.3 percent at grade 11 and to approximately 7 percent at grade 12.

6. Biological Science: Molecules to Man (BSCS Blue)

Data on Table 4.31 show that BSCS Blue Biology was used in high schools at grades 9 through 12. The percentage of the use of this text was highest (approximately 6 percent) at grade 10. It decreased to 4.4 percent at grade 9 and to approximately 3 percent at grade 11.

7. Focus on Life Science (Heimler)

Data on Table 4.31 show that this life science book was more commonly used in the junior high schools at grades 7 and 8. The textbook was most frequently used at grade 7 (28 percent). The percentage decreased to 4 percent at grade 8 and to approximately 3 percent at grades 10 through 12.

8. Living Things (Fitzpatrick)

Table 4.31 shows that this life science book was used at all grades but 7 and 8. The use of this textbook was highest at grade 10 (8.3 percent). The percentage decreased to approximately 6 percent at grade 11 and to 4.2 percent at grade 12.

9. Interaction of Man and the Biosphere: Inquiry in Life Science (Abraham)

Data on Table 4.31 show that this textbook was most commonly used in junior high schools at grade 7 (12 percent).

10. Life: Its Forms and Changes

Data on Table 4.31 show this life science book was used in grades 7 and 10. The percentage of the use of this textbook was quite similar at grades 7 and 10.

Chemistry

Examination of the data on Table 4.31 shows that chemistry courses appeared to be most commonly offered in high schools at grades 10 through 12 during the 1979/80 school year. Table 4.31 shows that the most commonly used textbooks in chemistry during the 1979/80 school year were those listed below.

1. Modern Chemistry (Metcalfe)

Data on Table 4.31 indicate that this chemistry textbook was used more frequently than any other chemistry textbook. This textbook was used in grades 9 through 12. The use of this book was highest at grade 11 (33.3 percent). Approximately 24 percent used it at twelfth grade and 16.7 percent at the tenth grade. Use of this chemistry textbook was lowest at grade 9 (approximately 3 percent).

2. Chemistry: Experiments and Principles (CHEM Study)

Data on Table 4.31 show that CHEMS was taught in high schools at grades 10 through 12. The percentage of grade levels using this course was highest at grade 11 (15 percent). The percentage decreased to approximately 10 percent at grade 10 and to 8.3 percent at grade 12.

3. Chemistry: An Investigative Approach (Cotton)

Data on Table 4.31 show that this chemistry textbook was used in high schools at grades 10 through 12. The use of this book was highest at grade 11 (8.3 percent). The percentage decreased to approximately 3 percent at grade 10.

4. Interdisciplinary Approach to Chemistry (IAC)

Data on Table 4.31 show that this chemistry book was used in high schools at grades 10 through 12. The use of this book was highest at grade 11 (4.2 percent). The percentage decreased to 1.4 percent at grades 10 and 12.

Physics

Examination of the data on Table 4.31 shows that physics courses appeared to be most commonly offered in high schools at grades 11 and 12 during the 1979/80 school year. Table 4.31 shows that the most commonly used textbooks or courses in physics during the 1979/80 school year were those listed below.

1. Modern Physics (Williams)

Data on Table 4.31 show that this physics textbook was used more frequently than any other physics textbook. It was used in high schools most frequently at grades 11 and 12. The use of the book was highest at grade 12 (approximately 31 percent). Use was 22.2 percent at grade 11.

2. Physical Science Study Committee (PSSC)

Data on Table 4.31 show that the PSSC materials were used in high schools primarily at grades 11 and 12. Use was 18.1 percent at grade 12 and 11.1 percent at grade 11.

3. The Project Physics (Rutherford)

Data on Table 4.31 show that the Project Physics materials were used in high schools primarily at grades 11 and 12. Use was 18.1 percent at grade 12, and about 7 percent at grade 11.

4. College Physics (Schaum)

Data on Table 4.31 show that this physics text was used in high schools at grades 10 through 12. The use of this book was highest at grade 12 (4.2 percent). The percentage decreased to 2.8 percent at grade 11 and to 1.4 percent at grade 10.

Physical Science

Examination of the data on Table 4.31 shows that physical science courses appeared to be offered primarily in grades 8 and 9. They were also offered by a number of schools in grades 10, 11 and 12; at this level, it usually was offered as a science course for students who did not take chemistry or physics.

Table 4.31 shows that the most commonly used textbooks in physical science during the 1979/80 school year were those listed below.

1. Introductory Physical Science (IPS) (Haber-Shaim)

Data on Table 4.31 show that the IPS physical science text was used most frequently in grades 8 and 9. Use of IPS was highest at grade 9 (approximately 15 percent). Use decreased to 12 percent at grade 8.

2. Modern Physical Science (Tracy)

Data on Table 4.31 show that this physical science textbook was used most commonly in high schools at grades 9 through 12. Use was highest at grade 11 (8.3 percent). Use decreased to approximately 6 percent at grades 9, 10 and 12.

Earth Science

Examination of the data on Table 4.31 shows that earth science appeared to be offered more frequently in junior high schools at grades 7 through 9. Earth science courses were also offered by some high schools at grades 10 and 11. Table 4.31 shows that the most commonly used textbooks in earth science during the 1979/80 school year were those listed below.

1. Earth Science: The World We Live in (Namowitz)

Data on Table 4.31 show that this textbook was used most frequently in junior high schools at grades 7 through 9. Use was highest at grade 9 (approximately 12 percent). Use decreased to 8 percent at grades 7 and 8. This textbook was used more frequently than any other earth science textbook.

2. Focus on Earth Science (Bishop)

Data on Table 4.31 show that this earth science textbook was used most at grades 8 through 10. Use was highest at grade 8 (24 percent). Use decreased to 4.2 percent at grades 9 and 10.

3. Investigating the Earth (ESCP)

Data on Table 4.31 show that ESCP was used most in grades 8 through 10. Use was highest at grade 8 (8 percent). Use decreased to 7.4 percent at grade 9 and to.4.2 percent at grade 10.

4. Modern Earth Science (Ramsey)

Data on Table 4.31 show that this textbook was used most in grades 7, 8 and 11. Use of this textbook was 4.2 percent at grade 11 and 4 percent at grades 7 and 8.

Other Courses or Textbooks

Intermediate Science Curriculum Study: Probing the Natural World (ISCS)

Data on Table 4.31 show that the ISCS materials were the only other materials with much use. This program was offered most frequently in junior high schools at grades 7 through 9. Use was highest at grade 7 (12 percent). Use decreased to approximately 6 percent at grade 9 and to 4 percent at grade 8.

General Science

Examination of the data in Table 4.32 indicates that general science courses appeared to be offered in secondary schools at all grades. However, junior high schools (Grades 7-9) more frequently offered general science than did high schools (Grades 10-12). The percentage of schools offering general science was 16 percent at grade 7, 12 percent at grade 8 and 13.2 percent at grade 9. It decreased to 8.3 percent at grade 10, approximately 7 percent at grade 11, and to 5.6 percent at grade 12.

TABLE 4.32

PERCENTAGE OF SCHOOLS WITH THAT GRADE LEVEL OFFERING GENERAL SCIENCE COURSES BY GRADE LEVEL

Grade level	Number of schools	Percent of schools
7	4	16.0
8	3	12.0
9	9	13.2
10	6	8.3
11	5	6.9
12	4	5.6

Specialized Science Courses

Principals of the sampled schools were asked to indicate if their schools were offering specialized science courses in other areas during the 1979/80 school year. Data on Table 4.33 indicate that other specialized science courses were taught in 75.3 percent of the schools.

Specialized science courses offered in schools during the 1979/80 school year are presented in this section. Data regarding grade levels offering specialized science courses in the six grades of secondary schools are shown in Table 4.33.

TABLE 4.33

FREQUENCY OF SCHOOLS OFFERING SPECIALIZED SCIENCE COURSES IN OTHER AREAS BY SCHOOL

Offering specialized science courses	Number of schools	Percent of schools
Yes	61	75.3
No	20	24.7
Total	81	100.0

Astronomy

Examination of the data on Table 4.34 indicates that astronomy courses appeared to be offered in high schools at grades 10 through

12. The percentage of schools offering astronomy courses was the same at grades 10, 11 and 12. Approximately 7 percent of schools offered astronomy courses in grades 10, 11 and 12. Few schools were teaching astronomy courses during the 1979/80 school year.

Physiology

Data on Table 4.34 indicate that physiology courses appeared to be offered most frequently in high schools at grades 10 through 12. Physiology was taught in approximately 28 percent of the schools in grade 12 and in 26.4 percent of the schools in grade 11. In the tenth grade, 11.1 percent of the schools taught physiology.

Zoology

Data on Table 4.34 indicate that zoology courses appeared to be offered in few high schools at grades 11 and 12. The percentage of schools offering zoology courses was the same, 4.2 percent, at grade 11 and 12.

Botany

Examination of the data on Table 4.34 indicates that botany courses appeared to be offered in high schools at grades 10 through 12. The percentage of schools offering botany courses was highest, approximately 10 percent, at grade 12. About 8.3 percent of the schools included botany in grade 11 and about 3 percent at grade 10.

TABLE 4.34

PERCENTAGE OF SCHOOLS WITH THESE GRADE LEVELS OFFERING SPECIALIZED SCIENCE COURSES BY GRADE LEVEL

	Grade levels					
	7	8	9	10	11	12
Science course	N(25)	N(25)	N(68)	N(72)	N(72)	N(7[illegible])
Astronomy	0.0	0.0	1.5	6.9	6.9	6.9
Physiology	0.0	0.0	1.5	11.1	26.4	27.8
Zoology	0.0	0.0	0.0	0.0	4.2	4.2
Botany	0.0	0.0	0.0	2.8	8.3	9.7
Oceanography	0.0	0.0	0.0	4.2	11.1	11.1
Geology	0.0	0.0	1.5	6.9	8.3	6.9
Advanced Biology (Second Year)	0.0	0.0	0.0	11.1	27.8	41.7
Advanced Chemistry (Second Year)	0.0	0.0	0.0	4.2	13.9	34.8
Advanced Physics (Second Year)	0.0	0.0	0.0	0.0	5.6	13.9
Honors science program	0.0	4.0	0.0	1.4	2.8	1.4

Oceanography

Examination of the data on Table 4.34, p. 195, indicates that oceanography courses appeared to be offered in high schools at grades 10 through 12. The percentage of schools offering oceanography courses was the same at grades 11 and 12, (11 percent). The number of schools offering oceanography decreased to 4.2 percent at grade 10.

Geology

Examination of the data on Table 4.34, p. 195, indicates that geology courses appeared to be offered in high schools, particularly in grades 10-12. Geology courses were offered more frequently at grade 11 than at grades 10 and 12 during the 1979/80 school year.

Advanced Biology (Second Year)

Table 4.34, p. 195, presents data regarding percentages of schools offering Advanced Biology by grade level. From this table it can be seen that this course was most frequently offered in high schools at grades 10 through 12. The Advanced Biology course was usually offered for students in grades 11 and 12 who had already completed one year of biology. The data show that Advanced Biology was offered most frequently in grade 12, approximately 42 percent, while approximately 28 percent of schools offered the course at grade 11, and 11.1 percent offered it at grade 10.

Advanced Chemistry (Second Year)

Table 4.34, p. 195, presents data regarding percentages of schools offering Advanced Chemistry by grade level. From this table it can be seen that this course was most frequently offered in high schools at grades 10 through 12. The Advanced Chemistry course was usually offered for students in grades 11 and 12 who had already completed one year of chemistry. The data show that Advanced Chemistry was offered most frequently in grade 12, approximately 35 percent, while approximately 14 percent of schools offered this course at grade 11, and 4.2 percent offered it at grade 10.

Advanced Physics

Table 4.34, p. 195, presents data regarding percentages of schools offering Advanced Physics by grade level. From this table it appears that this course was offered in high schools at grades 11 and 12. The Advanced Physics course is usually offered in grade 12 for students who had completed one year of Physics or Physical Science. The data show that Advanced Physics was offered more frequently at grade 12 (approximately 14 percent) than at grade 11 (approximately 6 percent).

Honors Science Programs

Table 4.34, p. 195, presents data regarding percentages of schools offering Honors Science Programs by grade level. It appears that Honors Science Programs were offered in secondary schools only at grades 8 and 11. Only 4 percent of schools at grade 8 offered the program, and approximately 3 percent of schools at grade 11.

Summary

Results presented previously in Table 4.31, p.184, show that the most commonly used science textbooks during the 1979/80 school year were those listed below.

1. Junior High Schools
    a. Life Science
        (1) Focus on Life Science (Heimler)
    b. Earth Science
        (1) Focus on Earth Science (Bishop)
        (2) Earth Science: The World We Live in (Namowitz)
    c. Physical Science
        (1) Introductory Physical Science (IPS) (Haber-Schaim)
    d. Others
        (1) Probing the Natural World (ISCS)
2. High Schools
    a. Biology
        (1) Modern Biology (Otto)
        (2) Biological Science: An Ecological Approach (BSCS Green)
        (3) Biology (Smallwood)
        (4) Biological Science: An Inquiry into Life (BSCS Yellow)
    b. Chemistry
        (1) Modern Chemistry (Metcalfe)

(2) Chemistry: Experiments and Principles (CHEM Study)

c. Physics

(1) Modern Physics (Williams)

(2) PSSC Physics (Haber-Schaim)

(3) The Project Physics (Rutherford)

TABLE 4.35

GENERAL SCIENCE TEXTBOOKS USED IN 5% OR MORE OF THE SAMPLE SCHOOLS DURING THE 1979/80 SCHOOL YEAR

Science course	Textbook	Percent of schools
General Science	Principles of Science Series (Heimler)	12.9
	Modern Science Series (Blank)	6.5

TABLE 4.36

FREQUENCY OF TEXTBOOK USE IN SELECTED SPECIALIZED SCIENCE COURSES

Course	Textbook	Percent of schools teaching the course using the book
Physiology	Human Physiology (Harrison)	49.0
	Structure and Function in Man (Jacob, Francone, and Lossow)	8.1
	Dynamic Anatomy and Physiology	5.4
Advanced Biology (Second Year)	Biology (Kimball)	12.5
	Modern Biology (Otto)	6.3
	Elements of Biology (Weisz)	6.3
	Science of Biology (Weisz)	6.3
	Biological Science: Interaction of Experiments and Ideas (BSCS)	6.3
Advanced Chemistry (Second Year)	Chemical Principles (Masterson and Slowinski)	19.3
	Foundations of Chemistry (Toon)	12.9
	Action Chemistry (Bolton)	6.5
	Chemistry: Experiments and Principles (CHEM Study)	6.5
	Interdisciplinary Approach to Chemistry (JAC)	6.5

Textbooks Used in General Science Courses and in Other Specialized Science Courses:

Each principal was requested to report the names of the textbooks which were being used in his or her school during the 1979/80 school year in general science courses and in other specialized science courses.

Examination of the data shows the following:

1. Textbooks Used in General Science Courses

The analysis of the data shows that a number of textbooks were being used in general science courses. Some of these textbooks reported by the principals as general science textbooks are not actually general science textbooks. Some of them are physical science; others are earth science or life science. The frequency of the majority of the general science textbooks reported is not presented here because of the very low percentage of usage.

Only two textbooks reported by the principals were used by more than 5% of the schools. Data on Table 4.35 show that the most frequently used (about 13 percent) general science taxtbook was Principles of Science Series (Heimler). Modern Science Series (Blank) was the second most used general science textbook.

Several schools reporting general science courses were not using general science materials.

2. Textbooks Used in other Specialized Science Courses

The analysis of the data shows that a number of textbooks were being used in other specialized science courses. Textbooks used by more than 5 percent of the schools teaching specialized science courses are presented in Table 4.36.

Publication Dates of Textbooks

Frequency distribution of publication dates of science textbooks used in the sampled schools during the 1979/80 school year as reported by the principals is shown in Table 4.37 .

Percentages are presented with regard to the total number of textbooks of each subject. Publication dates of textbooks of each science subject were categorized in five periods. Results show the following:

Biology and Life Science

About 49 percent of biology or life science textbooks were published between 1975 and 1979, and 36.9 percent were published between 1970 and 1974. Some schools were using materials more than ten years old (11.8 percent published between 1965 and 1969, and 1.9 percent published before 1964) during the 1979/80 school year.

Chemistry

Data on Table 4.37 , p. 204, indicate that half of the chemistry textbooks used in the sample schools during the 1979/80 school year were published between 1975 and 1979. About 40 percent were published between 1970 and 1974.

Physics

Data on Table 4.37, p. 204, show that more than half (55 percent) of the physics textbooks were published between 1975 and 1979. About 37.5 percent were published between 1970 and 1974. A relatively low percentage, 7.5 percent, were more than 10 years old.

Physical Science

While 48 percent of the physical science textbooks were published between 1975 and 1979, 36 percent were published between 1970 and 1974. Some schools were using physical science textbooks more than 10 years old (16 percent published between 1965 and 1969, and 4 percent published before 1964) during the 1979/80 school year.

Earth Science

Data on Table 4.37 , p. 204 , show that approximately 45 percent of the earth science textbooks were published between 1975 and 1979. About 24.1 percent were published between 1970 and 1974. Approximately 28 percent of the earth science textbooks were more than 10 years old (published between 1965 and 1969); this was the highest of the content areas.

Other Textbooks

A high percentage of the textbooks used in the sample schools in other science subjects, 66.7 percent, were published between 1970 and 1974. About 22.2 percent were published between 1975 and 1979 and 11.1 percent between 1965 and 1969.

Summary

Data presented show that about half of the textbooks of major science subjects (biology, chemistry, physics, physical science and earth science) which were being used during the 1979/80 school year were five years old or less. Generally, the majority of the textbooks used were published after 1970. On the other hand some schools were using materials more than 10 years old and very few more than 15 years old. Texts used in earth science were frequently older than average.

TABLE 4.37

FREQUENCY DISTRIBUTION OF PUBLICATION DATES OF MAJOR TEXTBOOKS USED IN SCIENCE BY SUBJECT AND TEXTBOOK

Subject	Before 64		1965-1969		1970-1974		1975-1979		1980		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Biology or Life Science	2	1.9	12	11.8	38	36.9	50	48.5	1	0.9	103	100.0
Chemistry	1	2.5	3	7.5	16	40.0	20	50.0	0	0.0	40	100.0
Physics	0	0.0	3	7.5	15	37.5	22	55.0	0	0.0	40	100.0
Physical Science	0	0.0	4	16.0	9	36.0	12	48.0	0	0.0	25	100.0
Earth Science	0	0.0	8	27.6	7	24.1	13	44.8	1	3.5	29	100.0
Other Textbooks	0	0.0	1	11.1	6	66.7	2	22.2	0	0.0	9	100.0

Schools Teaching Environmental Education or Conservation Education

Principals were asked to indicate if environmental education or conservation education were taught in their schools. Data on Table 4.38 indicate that during the 1979/80 school year environmental education was being taught in 80.4 percent of the schools.

TABLE 4.38

FREQUENCY OF SCHOOLS TEACHING ENVIRONMENTAL/CONSERVATION EDUCATION BY SCHOOL

Teaching EE or CE	Number of schools	Percent of schools
Yes	78	80.4
No	19	19.6
Total	97	100.0

Environmental Education as a Separate Subject

Data regarding schools teaching environmental education as a separate subject in the six grades of secondary schools are shown in Table 4.39. Percentages of schools offering environmental education courses by grade level are presented. The data clearly indicate that few schools in grades 7, 8 and 9 were teaching environmental education as a separate subject. The percentages were higher for grades 10, 11 and 12. The percentage was highest (22.2 percent) at grade 12, and approximately 21 percent at grade 11.

TABLE 4.39

SCHOOLS TEACHING ENVIRONMENTAL EDUCATION AS A SEPARATE SUBJECT BY GRADE LEVEL

Grade level	Number of schools	Percent of schools at each grade level
7	1	4.0
8	1	4.0
9	2	2.9
10	11	15.3
11	15	20.8
12	16	22.2

Environmental Education in Science

Data regarding schools that included units or content in environmental education within the science curriculum are shown by grades in Table 4.40. Principals reported it was included in seventh grade science courses in 64 percent of the schools and in the eighth grade in 56 percent of the schools. At the ninth grade level 40 percent of the schools taught environmental education with science. This increased to 40.0 percent at the tenth grade and then decreased to 29.2 percent in the eleventh and 26.4 percent in the twelfth grade.

From these data it is evident that most students receive science-related environmental studies in grades 7, 8, 9 and 10.

TABLE 4.40

PERCENTAGE OF SCHOOLS TEACHING ENVIRONMENTAL EDUCATION WITH SCIENCE BY GRADE AND BY SCHOOL

Grade level	Number of schools	Percent of schools at each grade level
7	16	64.0
8	14	56.0
9	27	40.0
10	29	40.3
11	21	29.2
12	19	26.4

Environmental Education with Social Studies

Much less environmental education was taught with social studies education than with science. Data on Table 4.41 indicate more integration with social studies from grade 9 through grade 12. At the eleventh grade 8.3 percent of the schools included environmental education with social studies courses.

Environmental Education Integrated with Two or More Subjects Including Science

Table 4.42 presents data regarding schools where environmental education was taught with two or more subjects including science. The data clearly indicate that secondary schools were teaching environmental education integrated with two or more subjects including science at grades 7 through 12. The highest percentage was reported at the seventh grade levels where 12 percent of the schools used this combination of subjects with environmental education. The percentage decreased to 8 percent at the eighth grade and to 4.4 percent at the ninth grade.

TABLE 4.41

PERCENTAGE OF SCHOOLS TEACHING ENVIRONMENTAL EDUCATION WITH SOCIAL STUDIES BY GRADE LEVEL

Grade level	Number of schools	Percent of schools at each grade level
7	1	4.0
8	1	4.0
9	4	5.9
10	4	5.6
11	6	8.3
12	4	5.6

TABLE 4.42

PERCENTAGE OF SCHOOLS TEACHING ENVIRONMENTAL EDUCATION WITH TWO OR MORE SUBJECTS INCLUDING SCIENCE BY GRADE LEVEL

Grade level	Number of schools	Percent of schools at each grade level
7	3	12.0
8	2	8.0
9	3	4.4
10	2	2.8
11	1	1.4
12	2	2.8

Environmental Education Integrated with Two or More Subjects Not Including Science

Data on Table 4.42 show that environmental education is seldom taught in subject combinations that do not include science.

TABLE 4.43

PERCENTAGE OF SCHOOLS TEACHING ENVIRONMENTAL EDUCATION WITH TWO OR MORE SUBJECTS NOT INCLUDING SCIENCE BY GRADE LEVEL

Grade level	Number of schools	*Percent of schools at each grade level
7	0	0.0
8	0	0.0
9	0	0.0
10	1	1.4
11	1	1.4
12	2	2.8

* Percentages of schools offering environmental education courses by grade level are presented in Tables 4.37 to 4.42 with regard to the total number of each grade level of all the sample schools.

Offering Separate Science Courses for Below Average and Gifted Students

Principals were asked to indicate whether their schools offer separate science courses for below average students and for gifted students. Data on Table 4.44 show that approximately 59 percent of the analyzed schools were offering separate science courses for below average students, while 60.4 percent were offering separate science courses for gifted students (Table 4.45) during the 1979/80 school year.

TABLE 4.44

FREQUENCY OF SCHOOLS OFFERING SEPARATE SCIENCE COURSES FOR BELOW AVERAGE STUDENTS BY SCHOOL

Science courses offered for below average students	Number of schools	Percent of schools
Yes	56	58.9
No	39	41.1
Total	95	100.0

TABLE 4.45

FREQUENCY OF SCHOOLS OFFERING SEPARATE SCIENCE COURSES FOR GIFTED STUDENTS BY SCHOOL

Science courses offered for gifted students	Number of schools	Percent of schools
Yes	55	60.4
No	36	39.6
Total	91	100.0

Each principal was also asked whether his or her school should offer separate science courses designed for below average students and gifted students. Table 4.46 shows that approximately 81 percent of principals responded positively that their schools should offer science courses for below average students, while approximately 78 percent principals agreed that their schools should offer separate science courses for gifted students (Table 4.47).

TABLE 4.46

PERCENTAGE OF SCHOOLS WHICH SHOULD OFFER SEPARATE SCIENCE COURSES TO BELOW AVERAGE STUDENTS BY SCHOOL

Science courses should be offered to below average students by school	Number of schools	Percent of schools
Yes	67	80.7
No	16	19.3
Total	83	100.0

TABLE 4.47

PERCENTAGE OF SCHOOLS WHICH SHOULD OFFER SCIENCE COURSES FOR GIFTED STUDENTS BY SCHOOL

Science courses should be offered to gifted students	Number of schools	Percent of schools
Yes	66	77.6
No	19	22.4
Total	85	100.0

Table 4.48 represents data regarding number and percentages of secondary schools, which have made major changes in their science programs since 1971. Principals of 84 percent of the schools reported that major changes in school science programs have taken place since 1971.

TABLE 4.48

FREQUENCY OF SCHOOLS HAVING MADE MAJOR CHANGES SINCE 1971 IN SCHOOL SCIENCE PROGRAM BY SCHOOL

Have major change in science program	Number of schools	Percent of schools
Yes	79	84.0
No	15	16.0
Total	94	100.0

Principals were asked to identify the major changes in their school science programs. Data on Table 4.49 present the frequency of various types of changes in science programs that took place. Results show that science courses were revised in 82.3 percent of the schools. Science courses were added in approximately 65 percent and eliminated in 32.9 percent of schools. A high percentage of schools (75.9 percent) changed science textbooks, while 49.4 percent developed new materials locally. Among the changes that took place, was reducing or increasing student course requirements in science.

TABLE 4.49

FREQUENCY OF MAJOR IN SCHOOL SCIENCE PROGRAMS THAT TOOK PLACE BY SCHOOL

Major changes	Yes		No		Total	
	Number of schools	Percent of schools	Number of schools	Percent of schools	Number of schools	Percent of schools
Revised courses	65	82.3	14	17.7	79	100.0
Changed textbooks	60	75.9	19	24.1	79	100.0
Added courses	51	64.6	28	35.4	79	100.0
Developed new materials	39	49.4	40	50.6	79	100.0
Eliminated courses	26	32.9	53	67.1	79	100.0
Increased student course requirements in science	17	21.5	62	78.5	79	100.0
Reduced student course requirements in science	3	3.8	76	96.2	79	100.0

Satisfaction with School Science Program

Principals were asked to rate their satisfaction with their science programs (Table 4.50). On a five point scale, 23.4 percent stated they were very satisfied. Approximately 60 percent stated they were satisfied, while 9.6 percent ranked their satisfaction at the middle of the scale (neutral). Only 7.5 percent of the principals marked their satisfaction with their science programs as below the middle of the scale.

TABLE 4.50

FREQUENCY DISTRIBUTION OF PRINCIPALS RANKING OF THEIR SATISFACTION WITH THEIR SCIENCE PROGRAMS BY SCHOOL

Degree of satisfaction	Number of schools	Percent of schools
Very satisfied	22	23.4
Satisfied	56	59.6
Neutral	9	9.6
Dissatisfied	6	6.4
Very dissatisfied	1	1.1
Total	94	100.0
Mean		4.106

THE SCIENCE TEACHER'S QUESTIONAIRE (Q:ST)

The secondary school science teachers in the sample are discussed in this section. The first part presents personal characteristics of the teachers population as to age, sex, highest degrees held, academic and professional background and participation in the National Science Foundation sponsored inservice activities.

This is followed by a part concerned with teaching assignments in science, science courses taught, average size of classes and relationship between areas of science courses taught and the academic background of science teachers.

The third part presents special science facilities which includes the availability of these facilities and the extent of their usage in the sample schools. The types of rooms used to conduct science classes are also presented.

The fourth part includes different types of curriculum materials and/or textbooks that were used for science classes. This part also presents the science courses or textbooks taught by each teacher during the 1979/80 school year. Included are the titles of the courses or textbooks, grade level of students, curriculum materials and major textbooks used with publication date, science courses for below average students and for gifted students, types of assistance the science teachers are in need in specific areas, and inservice training opportunities for science teachers.

The fifth part includes learning activities used by teachers. The sixth part is concerned with change. It presents the major changes in the classroom science and basic reasons for changes since

1971. Finally, science teachers were requested to rate their level of satisfaction with teaching science as a career and to report what they would like to change if they were dissatisfied with their science programs.

Teacher Characteristics

Table 4.51 presents the number and percentages of the participating secondary school science teachers in each of the eight regions of the USA. The total sample teachers participating in this study was 288.

TABLE 4.51

FREQUENCY DISTRIBUTION OF THE SAMPLE OF SCIENCE TEACHERS BY REGION

Region	Number of teachers	Percent of teachers
Great Lakes	36	12.5
Farwest	31	10.8
New England	29	10.1
Mid-East	30	10.4
Southwest	27	9.4
Rocky Mountains	30	10.4
Plains	57	19.8
Southeast	48	16.7
Total	288	100.0

Age of Teachers

Teachers were grouped in ten year age groups for analysis. Data on Table 4.52 show that the average age of science teachers in the sample schools was 35.56 years. The number of teachers in the 30 to 39 age group was highest (approximately 43 percent). Few science teachers (approximately 4 percent) were more than 60 years old.

TABLE 4.52

FREQUENCY DISTRIBUTION OF THE AGES OF TEACHERS IN THE SAMPLE OF PUBLIC SECONDARY SCHOOLS BY TEACHER

Age	Number of teachers	Percent of teachers
20-29	36	12.5
30-39	123	42.7
40-49	75	26.0
50-59	43	14.9
60-69	11	3.8
Total	288	100.0

Mean = 35.6 years

Sex of Science Teachers

Table 4.53 indicates that 28.4 percent of the participating teachers were female, while approximately 72 percent were male.

TABLE 4.53

FREQUENCY DISTRIBUTION OF THE TEACHERS BY SEX

Sex	Number of teachers	Percent of teachers
Female	81	28.4
Male	204	71.6
Total	285	100.0

Highest Degree Held by Science Teachers

Data on Table 4.54 show that master's degrees were the highest degrees held by 68.2 percent of the science teachers. Bachelor's degrees were the highest degrees held by 31.1 percent of the teachers and only 0.7 percent held a doctorate.

TABLE 4.54

FREQUENCY DISTRIBUTION OF THE HIGHEST DEGREE HELD BY TEACHERS

Highest degree	Number of teachers	Percent of teachers
BS or BA	89	31.1
MS or MA	195	68.2
Ph.D. or Ed.D.	2	0.7
Total	285	100.0

Academic and Professional Backgrounds of the Science Teachers

To provide additional information about the background of science teachers by subject matter fields, sample teachers were asked to specify the major and minor subject matter fields of their degrees. Table 4.55 presents the number and percentages of science teachers having each of the major areas of science of their degrees as a major or a minor.

Biological Science or Life Science

As shown in Table 4.55, approximately 50 percent of the science teachers reported that they had biology or life science as a major while 8.4 percent reported that they had biology or life science as a minor.

Chemistry

Data on Table 4.55 show that 17 percent of the science teachers reported that they had chemistry as a major while 16 percent reported that they had chemistry as a minor.

Physics

As shown in Table 4.55, only 6.3 percent of the teachers reported that they had physics as a major, and only 7.3 percent reported a minor.

Physical Science

Of the science teachers responding, very few had physical science as a major, approximately 3 percent, or as a minor, 2.4

TABLE 4.55

PERCENTAGES OF SCIENCE TEACHERS HAVING EACH OF THE MAJOR AREAS OF SCIENCE TEACHERS OF THEIR DEGREES AS A MAJOR OR AS A MINOR BY SUBJECT AND TEACHER

Subject matter fields	Major		Minor		Not Major or Minor		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Biology or Life Science	142	49.5	24	8.4	121	42.1	287	100.0
Chemistry	49	17.1	46	16.0	192	66.9	287	100.0
Physics	18	6.3	21	7.3	248	86.4	287	100.0
Physical Science	8	2.8	7	2.4	272	94.8	287	100.0
Earth Science	23	8.0	15	5.2	249	86.8	287	100.0
General Science	36	12.5	20	7.0	231	80.5	287	100.0
Other subjects	141	49.2	73	25.4	73	25.4	287	100.0

percent.

Earth Science

Data on Table 4.55 shows that the percentage of science teachers having earth science as a major was only 8 percent. Only 5.2 percent of the teachers had earth science as a minor.

General Science

As shown in Table 4.55, approximately 13 percent of the teachers had general science as a major while 7 percent had it as a minor.

Other Subjects Matter Fields

Science teachers reported several other subject areas as their major or minors. Data on Table 4.55 show that 49.1 percent of all teachers reported that they had other subject matter fields as majors while 25.4 percent had other subject areas as minors.

Attendance at NSF-Sponsored Inservice Activities

Science teachers were asked if they had attended any NSF sponsored institutes, conferences or workshops.

Table 4.56 shows the percentage of science teachers who had attended NSF-sponsored activities. Approximately 55 percent of the teachers reporting attended one or more of these activities.

TABLE 4.56

FREQUENCY DISTRIBUTION OF NATIONAL SCIENCE FOUNDATION-SPONSORED INSERVICE ACTIVITIES ATTENDED BY TEACHERS

Attended NSF inservice activities	Number of teachers	Percent of teachers
Yes	156	54.5
No	130	45.5
Total	286	100.0

Each teacher was asked to indicate the type of NSF-sponsored inservice activity he or she had attended. Table 4.57 presents percentages of science teachers participating in NSF-sponsored institutes, conferences or workshops with regard to the total number of teachers responding to each item.

Summer Institutes

A large number of the sample teachers had participated in Summer Institutes sponsored by the National Science Foundation. Table 4.57 indicates that the most frequently attended inservice activity for science teachers was the NSF Summer Institutes. The percentage of participation in Summer Institutes was the highest of all NSF-sponsored activities (75.6 percent).

TABLE 4.57

FREQUENCY DISTRIBUTION OF SCIENCE TEACHERS PARTICIPATING IN NSF-SPONSORED ACTIVITIES BY TEACHERS

NSF Activity	Yes		No		Total	
	Number	Percent	Number	Percent	Number	Percent
Prior to 1974						
Academic Year Institutes	26	16.7	130	83.3	156	100.0
Administrators Conference	0	0.0	156	100.0	156	100.0
Cooperative College-School Science Program	18	11.5	138	88.5	156	100.0
Inservice Institutes	42	26.9	114	73.1	156	100.0
Resource Personnel Workshops	4	2.6	152	97.4	156	100.0
Summer Institutes	118	75.6	38	24.4	156	100.0
After 1974						
Chautauqua Short Courses	1	0.6	155	99.4	156	100.0
Leadership Development Projects	3	1.9	153	98.1	156	100.0
School System Projects	14	9.0	142	91.0	156	100.0
Teacher Centered Projects	23	14.7	133	85.3	156	100.0

Inservice Institutes

The National Science Foundation has sponsored several types of inservice institutes. A common type early in the program was one designed to help a teacher get ready for adopting or adapting a specific science course such as BSCS, PSSC or CHEMS. Regularly scheduled meetings were held during the major portion of the school year. Another type of inservice institutes was the Co-operative College School Science Program. Usually these institutes included a summer program as well as inservice meetings during the school year.

Table 4.57 indicates that approximately 27 percent of the science teachers had attended those inservice institutes.

Academic Year Institutes

The National Science Foundation (NSF) used to make it possible for many science teachers and mathematics teachers to have a year of concentrated study in their teaching fields at the Academic Year Institute.

Table 4.57 indicates that of the science teachers responding only 16.7 percent had attended the Academic Year Institutes.

Teacher Centered Projects

As shown in Table 4.57, 14.7 percent of science teachers attended the teacher centered projects.

Co-operative College-School Science Program

As shown in Table 4.57, 11.5 percent of the science teachers responding, attended this program.

School System Projects

Data on Table 4.57 indicate that 9 percent of the science teachers participated in School System Projects.

Resource Personnel Workshops

Data on Table 4.57 indicate that only 2.6 percent of the science teachers attended these workshops.

Leadership Development Projects

As shown in Table 4.57, very low percent of the science teachers, 1.9 percent, attended the Leadership Development Projects.

As presented before and from the data on Table 4.57, it is clear that Summer Institutes were the most frequently attended NSF sponsored activity, while Inservice Institutes were the second most frequently attended activity by the sample science teachers.

Teaching Load

Science Subjects or Courses Offered

Each science teacher was asked to specify science subjects or courses he or she was teaching during the 1979/80 school year. The relationship of science subjects or courses taught and academic background of science teachers were also identified.

Biological or Life Science

Data on Table 4.58 indicate that of the sample teachers approximately 53 percent of science teachers reported that they were teaching biology or life science courses during the 1979/80 school year.

TABLE 4.58

FREQUENCY OF SCIENCE TEACHERS TEACHING BIOLOGY OR LIFE SCIENCE COURSES BY TEACHER

Offering courses	Number of teachers	Percent of teachers
Yes	151	52.8
No	135	47.2
Total	286	100.0

Table 4.66 shows that of those teachers who taught biology or life science courses approximately 73 percent had biology or life science as a major, and 11.3 percent had biology or life science as a minor. Approximately 16 percent of teachers who taught biology did not have biology or life science as a major or as a minor.

Chemistry

Data on Table 4.60 indicate that 24.1 percent of the science teachers were teaching chemistry courses during the 1979/80 school year.

TABLE 4.60

FREQUENCY OF SCIENCE TEACHERS TEACHING CHEMISTRY COURSES BY TEACHER

Offering courses	Number of teachers	Percent of teachers
Yes	68	24.1
No	214	75.9
Total	282	100.0

Table 4.66 shows that of those teachers who taught chemistry courses approximately 52 percent had chemistry as a major, and 27.9 percent had chemistry as a minor. Approximately 21 percent of science teachers did not have chemistry as a major or as a minor.

Physics

Data on Table 4.61 indicate that approximately 16 percent of the science teachers reported that they were teaching physics courses during the 1979/80 school year.

Table 4.66 shows that of those teachers who taught physics approximately 36 percent had physics as a major, and 37.8 percent had physics as a minor.

TABLE 4.61

FREQUENCY OF SCIENCE TEACHERS TEACHING PHYSICS COURSES BY TEACHER

Offering courses	Number of teachers	Percent of teachers
Yes	45	15.9
No	238	84.1
Total	283	100.0

Approximately 27 percent of science teachers did not have physics as a major or as a minor.

Physical Science

Data on Table 4.62 indicate that 24.1 percent of the science teachers reported that they were teaching physical science during the 1979/80 school year.

Table 4.66 shows that of those teachers who taught physical science courses approximately 3 percent had physical science as a major and 4.4 percent had physical science as a minor. Approximately 93 percent of science teachers did not have physical science as a major or minor; many however, had chemistry or physics as majors or minors.

TABLE 4.62

FREQUENCY OF SCIENCE TEACHERS TEACHING PHYSICAL SCIENCE BY TEACHER

Offering courses	Number of teachers	Percent of teachers
Yes	68	24.1
No	214	75.9
Total	282	100.0

Earth Science

Data on Table 4.63 indicate that 14.2 percent of the science teachers reported that they were teaching earth science courses during tne 1979/80 school year.

Table 4.66 shows that of those teachers who taught earth science courses 35 percent had earth science as a major, and 15 percent had earth science as a minor. Fifty percent of the teachers did not have earth science as a major or as a minor and appeared to have relatively little academic earth science work.

General Science

Data on Table 4.64 indicate that 8.5 percent of the science teachers reported that they were teaching general science during the 1979/80 school year.

Table 4.66 shows that of those teachers who taught general

TABLE 4.63

FREQUENCY OF SCIENCE TEACHERS TEACHING EARTH SCIENCE BY TEACHER

Offering courses	Number of teachers	Percent of teachers
Yes	40	14.2
No	242	85.8
Total	282	100.0

TABLE 4.64

FREQUENCY OF SCIENCE TEACHERS TEACHING GENERAL SCIENCE BY TEACHER

Offering courses	Number of teachers	Percent of teachers
Yes	24	8.6
No	255	91.4
Total	279	100.0

science courses 8.3 percent had general science as a major, and approximately 21 percent had general science as a minor. Approximately 71 percent of teachers did not have general science as a major or as a minor; nearly all had a major or minor in science.

Other Science Subjects or Courses

Data on Table 4.65 indicate that 19.4 percent of the science teachers reported that they were teaching other science subjects or courses during the 1979/80 school year.

Table 4.66 shows that of those teachers who taught other science subjects or courses 9.3 percent had these other areas as a major and 11.1 percent had these other areas as a minor. Approximately 80 percent of teachers did not have these other areas as a major or as a minor; many did have majors or minors in related science areas.

TABLE 4.65

FREQUENCY OF SCIENCE TEACHERS TEACHING OTHER SUBJECTS OR COURSES BY TEACHERS

Offering courses	Number of teachers	Percent of teachers
Yes	54	19.4
No	225	80.6
Total	279	100.0

TABLE 4.66

FREQUENCY RELATIONSHIP OF SCIENCE SUBJECTS OR COURSES TAUGHT WITH ACADEMIC BACKGROUND OF SCIENCE TEACHERS BY SUBJECT AND TEACHER

Science subject or course	Relation of subject or course taught with teachers background							
	Major		Minor		Not Major or Minor		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Biology or Life Science	110	72.8	17	11.3	24	15.9	151	100.0
Chemistry	35	51.5	19	27.9	14	20.6	68	100.0
Physics	16	35.5	17	37.8	12	26.7	45	100.0
Physical Science	2	2.9	3	4.4	63*	92.7	68	100.0
Earth Science	14	35.0	6	15.0	20	50.0	40	100.0
General Science	2	8.3	5	20.8	17	70.9	24	100.0
Others	5	9.3	6	11.1	43**	79.6	54	100.0

* Many of these teachers had majors or minors in chemistry or physics.
** Many of these teachers had majors or minors in related science areas.

Summary

Data reported by science teachers indicate that biology or life science courses were the most frequently taught science courses during the 1979/80 school year. Chemistry courses and physical science courses were next in frequency. Results also show that biology or life science teachers were the best prepared science teachers with approximately 73 percent teachers having biology or life science as a major.

Average Size of Classes

Each science teacher was asked to specify the average class size of the courses he or she was teaching during the 1979/80 school year. Data on Table 4.67 show that classes averaging from 15 to 19 students made up 8 percent of the biology classes, approximately 34 percent of the chemistry classes, 40 percent of the physics classes, 16.2 percent of the physical science classes, 10 percent of the earth science classes and approximately 17 percent of the general science classes.

Classes averaging from 20 to 24 students made up 41.1 percent of the biology classes, approximately 46 percent of the chemistry classes, 29 percent of the physics classes, 25 percent of the physical science classes, 30 percent of the earth science classes and 42 percent of the general science classes.

Classes averaging from 25 to 29 students made up approximately 34 percent of the biology courses, 8.8 percent of the chemistry classes, 4.4 percent of the physics, 41.2 percent of the physical science classes, 35 percent of the earth science and approximately 17 percent of the general science classes.

TABLE 4.67

FREQUENCY DISTRIBUTION OF AVERAGE CLASS SIZE OF COURSES TAUGHT BY SCIENCE SUBJECT

Class size	Biology		Chemistry		Physics		Physical science		Earth science		General science		Others	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
1-9	2	1.3	0	0.0	2	4.4	0	0.0	0	0.0	0	0.0	3	5.6
10-14	2	1.3	5	7.4	9	20.0	0	0.0	2	5.0	1	4.1	4	7.4
15-19	12	8.0	23	33.8	18	40.0	11	16.2	4	10.0	4	16.7	6	11.1
20-24	62	41.1	31	45.6	13	29.0	17	25.0	12	30.0	10	41.7	15	27.8
25-29	51	33.8	6	8.8	2	4.4	28	41.2	14	35.0	4	16.7	16	29.6
30-34	20	13.2	3	4.4	0	0.0	12	17.6	7	17.5	4	16.7	7	12.9
35- up	2	1.3	0	0.0	1	2.2	0	0.0	1	2.5	1	4.1	3	5.6
Totals	151	100.0	68	100.0	45	100.0	68	100.0	40	100.0	24	100.0	54	100.0
Mean	24.4		20.4		17.9		24.4		24.1		23.2		22.0	
SD	13.4		9.0		6.9		10.7		8.8		6.7		9.4	

Classes averaging from 30 to 34 students made up 13.2 percent of the biology courses, 4.4 percent of the chemistry classes, approximately 18 percent of the physical science classes, 17.5 percent of the earth science,and approximately 17 percent of the general science. There were a few very small classes, and a few very large classes.

Class size means of various science subjects ranged from 17.9 to 24.4 students per class. The class size means for biology and earth science were the highest with 24.4 students per class, while the mean of physics was the lowest with 17.9 students per class.

Facilities and Equipment for Science Courses

Teachers were asked to check the science facilities and equipment that were available for their science teaching and to rank the use they made of these facilities in their classes. The list of facilities are presented in the order of availability as reported by the sample of teachers. In presenting the use of the various facilities the base number used was the number of teachers having the facility available.

Videotape Recorder/Player

Data on Table 4.68 show that of the science teachers checking this item 79.1 percent reported that videotape recorders or players were available in their schools. Of the science teachers having videotape recorders/players available approximately 6 percent used them frequently, 28.7 percent occasionally and 63.9 percent rarely and 1.8 percent of the teachers did not respond.

TABLE 4.68

FREQUENCY DISTRIBUTION OF AVAILABILITY AND TEACHER'S USE OF VIDEOTAPE RECORDER/PLAYER BY TEACHER

Available	Number of teachers	Percent of teachers
Yes	216	79.1
No	57	20.9
Total	273	100.0

Use	Number of teachers	Percent of teachers
Frequently	12	5.6
Occasionally	62	28.7
Rarely	138	63.9
No response	4	1.8
Total	216	100.0

Computer of Computer Terminals

The computer or computer terminal in a school is a relatively recent additional resource for science teaching. Data on Table 4.69 show that of the science teachers responding to this item, 49.3 percent reported the availability of such equipment of the science teachers having this equipment, 67.4 percent used it rarely, 18.2

percent occasionally, 12.1 percent frequently and 2.3 percent of the teachers did not respond.

TABLE 4.69

FREQUENCY DISTRIBUTION OF AVAILABILITY AND TEACHER'S USE OF COMPUTER TERMINAL(S) BY TEACHER

Available	Number of teachers	Percent of teachers
Yes	132	49.3
No	135	50.4
Total	268	100.0

Use	Number of teachers	Percent of teachers
Frequently	16	12.1
Occasionally	24	18.2
Rarely	89	67.4
No response	3	2.3
Total	132	100.0

Broadcast Television

Data on Table 4.70 show that of the science teachers responding to this item, 40.2 percent reported that broadcast television was available in their schools. Of the science teachers having broadcast television available only one percent used it frequently, 15.1 percent occasionally, 80 percent rarely and 3.8 percent did not respond.

TABLE 4.70

FREQUENCY DISTRIBUTION OF AVAILABILITY AND TEACHER'S USE OF BROADCAST TELEVISION BY TEACHER

Available	Number of teachers	Percent of teachers
Yes	106	40.2
No	158	59.8
Total	264	100.0

Use	Number of teachers	Percent of teachers
Frequently	1	0.9
Occasionally	16	15.1
Rarely	85	80.2
No response	4	3.8
Total	106	100.0

Greenhouses

Data on Table 4.71 indicate that greenhouses were available for approximately 36 percent of the science teachers responding to this item. Of the science teachers having greenhouses 13.6 percent used them frequently, 19.8 percent occasionally, and 63.5 percent of the teachers used them rarely for their science classes.

TABLE 4.71

FREQUENCY DISTRIBUTION OF AVAILABILITY AND TEACHER'S USE OF GREENHOUSE BY SCHOOL

Available	Number of teachers	Percent of teachers
Yes	96	35.8
No	172	64.2
Total	268	100.0

Use	Number of teachers	Percent of teachers
Frequently	13	13.6
Occasionally	19	19.8
Rarely	61	63.5
No response	3	3.1
Total	96	100.0

Nature Trails

Data on Table 4.72 indicate that nature trails were available for 31.7 percent of the science teachers reporting. Of the science teachers having nature trails available in their schools only 1.2 percent used them frequently, 21.7 occasionally, 73.5 rarely and 3.6 percent of the teachers did not respond.

TABLE 4.72

FREQUENCY DISTRIBUTION OF AVAILABILITY AND TEACHER'S USE OF NATURE TRAIL(S) BY TEACHERS

Available	Number of teachers	Percent of teachers
Yes	83	31.7
No	179	68.3
Total	262	100.0

Use	Number of teachers	Percent of teachers
Frequently	1	1.2
Occasionally	18	21.7
Rarely	61	73.5
No response	3	3.6
Total	83	100.0

Closed-Circuit Television

Data on Table 4.73 show that of the science teachers responding, 30.2 percent reported that closed circuit television was available in their schools. Of the science teachers having closed circuit television available 2.5 percent used it frequently, 19.7 percent occasionally, 75.3 rarely, and 2.5 percent of the teachers did not respond.

TABLE 4.73

FREQUENCY DISTRIBUTION OF AVAILABILITY AND TEACHER'S USE OF CLOSED CIRCUIT TELEVISION BY TEACHER

Available	Number of teachers	Percent of teachers
Yes	81	30.2
No	187	89.8
Total	268	100.0

Use	Number of teachers	Percent of teachers
Frequently	2	2.5
Occasionally	16	19.7
Rarely	61	75.3
No response	2	2.5
Total	81	100.0

Science Darkrooms

Science darkrooms were available for 28.1 percent of the science teachers reporting (Table 4.74). Of the science teachers having darkrooms available in their schools 80 percent used them rarely, 13.3 percent occasionally, 4 percent frequently, and 2.7 percent of the teachers did not respond.

TABLE 4.74

FREQUENCY DISTRIBUTION OF AVAILABILITY AND TEACHER'S USE OF SCIENCE DARKROOM BY TEACHER

Available	Number of teachers	Percent of teachers
Yes	75	28.1
No	192	71.9
Total	267	100.0

Use	Number of teachers	Percent of teachers
Frequently	3	4.0
Occasionally	10	13.3
Rarely	60	80.0
No response	2	2.7
Total	75	100.0

The Planetarium

A planetarium was available in schools for 22.3 percent of the science teachers checking this item (Table 4.75). Of the science teachers having this facility available approximately 85 percent used it rarely, 8.5 percent occasionally, 3.4 percent frequently and 3.4 percent of the teachers did not respond.

TABLE 4.75

FREQUENCY DISTRIBUTION OF AVAILABILITY AND TEACHER'S USE OF PLANETARIUM BY TEACHER

Available	Number of teachers	Percent of teachers
Yes	59	22.3
No	206	77.7
Total	265	100.0

Use	Number of teachers	Percent of teachers
Frequently	2	3.4
Occasionally	5	8.5
Rarely	50	84.7
No response	2	3.4
Total	59	100.0

Land Laboratory

Land laboratories were available for 20.2 percent of the science teachers responding to this item (Table 4.76). Of the science teachers having this facility available in their schools 7.5 percent used it frequently, 35.9 percent occasionally, 50.9 percent rarely and 5.7 percent of teachers did not respond. Use of the land laboratory was more frequent in districts that had programs encouraging use of outdoor facilities.

TABLE 4.76

FREQUENCY DISTRIBUTION OF AVAILABILITY AND TEACHER'S USE OF LAND LABORATORY BY TEACHER

Available	Number of teachers	Percent of teachers
Yes	53	20.2
No	209	79.8
Total	262	100.0

Use	Number of teachers	Percent of teachers
Frequently	4	7.5
Occasionally	19	35.9
Rarely	27	50.9
No response	3	5.7
Total	53	100.0

Weather Stations

Weather stations were available for 17.6 percent of the science teachers responding to this item (Table 4.77). Of the science teachers having weather stations, approximately 24 percent used them frequently, 21.8 percent occasionally, 47.8 percent rarely and 6.5 percent of the teachers did not respond.

TABLE 4.77

FREQUENCY DISTRIBUTION OF AVAILABILITY AND TEACHER'S USE OF WEATHER STATION BY TEACHER

Available	Number of teachers	Percent of teachers
Yes	46	17.6
No	216	82.4
Total	262	100.0

Use	Number of teachers	Percent of teachers
Frequently	11	23.9
Occasionally	10	21.8
Rarely	22	47.8
No response	3	6.5
Total	46	100.0

Auto-tutorial Laboratories

Auto-tutorial laboratories were available for 12.9 percent of the science teachers checking this item (Table 4.78). Of the science teachers having this facility available in their schools 29.4 percent used it frequently, 29.4 percent occasionally, and 41.2 used it rarely in their science classes.

TABLE 4.78

FREQUENCY DISTRIBUTION OF AVAILABILITY AND TEACHER'S USE OF AUTO-TUTORIAL LABORATORY BY TEACHER

Available	Number of teachers	Percent of teachers
Yes	34	12.9
No	230	87.1
Total	264	100.0

Use	Number of teachers	Percent of teachers
Frequently	10	29.4
Occasionally	10	29.4
Rarely	14	41.2
No response	0	0.0
Total	34	100.0

Ventilated Animal Houses or Facilities

Ventilated animal houses or facilities were available for 10.3 percent of the science teachers checking this item (Table 4.79). Of the science teachers having the facility, 55.6 percent used it rarely, 29.6 percent occasionally, 11.1 percent frequently, and 3.7 percent of teachers did not respond.

TABLE 4.79

FREQUENCY DISTRIBUTION OF AVAILABILITY AND TEACHER'S USE OF VENTILATED ANIMAL HOUSE BY TEACHER

Available	Number of teachers	Percent of teachers
Yes	27	10.3
No	235	89.7
Total	262	100.0

Use	Number of teachers	Percent of teachers
Frequently	3	11.1
Occasionally	8	29.6
Rarely	15	55.6
No response	1	3.7
Total	27	100.0

The Observatory

Data on Table 4.80 indicate that of the science teachers responding to this item, only 6.1 percent reported the availability of an observatory in their schools. Teacher use of the observatory was low with 81.4 percent reporting rarely using it, 6.2 percent occasionally, and 6.2 percent frequently; 6.2 percent of teachers did not respond.

TABLE 4.80

FREQUENCY DISTRIBUTION OF AVAILABILITY AND TEACHER'S USE OF OBSERVATORY BY TEACHER

Available	Number of teachers	Percent of teachers
Yes	16	6.1
No	246	93.9
Total	262	100.0
Frequently	1	6.2
Occasionally	1	6.2
Rarely	13	81.4
No response	1	6.2
Total	16	100.0

The Ham Radio Station

Amateur or ham radio stations have been located in some secondary schools for many years. Only properly licensed individuals may operate these stations. Data on Table 4.81 indicate that the ham radio stations were available for only 4.2 percent of the science teachers checking this item. Teacher use of the ham radio station was low with 9.1 percent reporting occasionally using it. Approximately 91 percent used this facility rarely for their science classes.

TABLE 4.81

FREQUENCY DISTRIBUTION OF AVAILABILITY AND TEACHER'S USE OF HAM RADIO STATION BY TEACHER

Available	Number of teachers	Percent of teachers
Yes	11	4.2
No	250	95.8
Total	261	100.0

Use	Number of teachers	Percent of teachers
Frequently	0	0.0
Occasionally	1	9.1
Rarely	10	90.9
No response	0	0.0
Total	11	100.0

Summary

Results presented previously show that videotape recorders/players were the most frequently available equipment in 79.1 percent of the secondary schools (7-12). Computer or computer terminals were the next most frequently available (49.3 percent) and broadcast television was the third most frequently available (40.2 percent). On the other hand, ham radio stations were the lowest available facility in schools (4.2 percent). The observatory was the next lowest (6.1 percent) and ventilated animal houses were the third lowest available facility (4.2 percent).

Results showed that the auto-tutorial laboratory was the most frequently used facility in secondary schools (about 59 percent). Weather stations were the next most frequently (approximately 46 percent) and land laboratories were the third most frequently used(43.4 percent). On the other hand, ham radio station was the lowest used facility in schools (9.1 percent). The planetarium was the next lowest used (11.9 percent) and the observatory was the third lowest used facility (12.4 percent).

Types of Science Classrooms

Science teachers were asked to specify the types of rooms where they used to conduct their science classes.

Data on Table 4.82 indicate that of the science teachers responding 76.4 percent reported that their science classes were taught in rooms they classified as laboratories or special rooms. Rooms with portable science kits or a portable demonstration desk made up approximately 11 percent of classroom selected by teachers.

TABLE 4.82

FREQUENCY DISTRIBUTION OF TYPES OF CLASSROOMS USED FOR SCIENCE COURSES BY TEACHER

Classroom type	Yes		No		Total	
	Number of teachers	Percent of teachers	Number of teachers	Percent of teachers	Number	Percent
Laboratory or special room	217	76.4	67	23.6	284	100.0
Classroom with portable science kits	31	10.9	254	89.1	284	100.0
Classroom with no science facilities or kits	14	4.9	270	95.1	284	100.0
Other rooms	31	10.9	254	89.1	284	100.0

Only 4.9 percent of the rooms had no science facilities.

Science Teaching

Curriculum Materials for Selected Class

Science teachers were asked to specify the kinds of curriculum materials and/or textbooks that they used for their science classes. Of the science teachers responding, 42 percent reported using a single textbook (Table 4.83). Another 33.6 percent used a textbook which included the laboratory manual. Multiple textbooks were reported by 29.4 percent of the teachers and approximately 28 percent reported the use of multiple textbooks including laboratory manual(s). A separate laboratory manual was used by 29.4 percent of teachers. Nearly 50 percent of the science teachers used some locally prepared curriculum materials.

TABLE 4.83

FREQUENCY DISTRIBUTION OF TYPES OF CURRICULUM MATERIALS USED FOR SCIENCE COURSES BY REGIONS

Types of materials	Total N = 286			
	Yes		No	
	Number	Percent	Number	Percent
Single text	120	42.0	166	58.0
Single textbook and lab manual	96	33.6	190	66.4
Multiple textbook	84	29.4	202	70.6
Multiple textbook and lab manual	79	27.6	207	72.4
Separate lab manual	84	29.4	202	70.6
Locally prepared materials	137	47.9	149	52.1
Others	48	16.8	237	83.2

Special Science Courses

Each science teacher was asked if he or she was teaching a separate science course during the 1979/80 school year for below average or gifted students. Teachers were also asked to specify if these special courses should be offered in their schools.

As shown in Table 4.84 approximately 31 percent of teachers were teaching separate science courses designed for below average students, while 30.3 percent of the teachers indicated that separate science courses should be offered for below average students in their schools (Table 4.85).

TABLE 4.84

FREQUENCY DISTRIBUTION OF SCIENCE TEACHERS TEACHING SEPARATE COURSES FOR BELOW AVERAGE STUDENTS BY TEACHER

Course offering	Number of teachers	Percent of teachers
Yes	85	30.7
No	192	69.3
Total	277	100.0

Of the science teachers responding, 29.1 percent were teaching separate science courses designed for gifted students (Table 4.86). However, over 86 percent of the science teachers indicated that separate science courses should be offered for gifted students in their schools (Table 4.87).

TABLE 4.85

FREQUENCY DISTRIBUTION OF SCIENCE TEACHERS ATTITUDE FOR OFFERING SEPARATE COURSES FOR BELOW AVERAGE STUDENTS BY TEACHER

Course offering	Number of teachers	Percent of teachers
Yes	224	80.3
No	55	19.7
Total	279	100.0

TABLE 4.86

FREQUENCY DISTRIBUTION OF SCIENCE TEACHERS TEACHING SEPARATE COURSES FOR GIFTED STUDENTS BY TEACHER

Course offering	Number of teachers	Percent of teachers
Yes	75	29.1
No	183	70.9
Total	258	100.0

TABLE 4.87

FREQUENCY DISTRIBUTION OF SCIENCE TEACHERS ATTITUDE FOR OFFERING SEPARATE COURSES FOR GIFTED STUDENTS BY TEACHER

Course offering	Number of teachers	Percent of teachers
Yes	238	86.2
No	38	13.8
Total	288	100.0

Teacher Need for Assistance

Each science teacher was asked to specify the type of assistance he or she needed. Thirteen areas of need are presented in Tables 4.88 through 4.102. Tables are arranged in order of percentages of need for assistance as reported by the sample of teachers.

Obtaining Information about Out-Of-School Resources

Of the science teachers responding to this item, 65.2 percent indicated a need for obtaining out-of-school resources (Table 4.88), while 34.8 percent did not feel this assistance was needed.

Obtaining Information about New Teaching Methods

Data on Table 4.89 show that of the science teachers checking this item, approximately 62 percent indicated a need for obtaining information about new teaching methods while 38.2 percent did not feel a need for this assistance.

TABLE 4.88

FREQUENCY DISTRIBUTION OF TEACHER'S NEED FOR OBTAINING INFORMATION ABOUT OUT-OF-SCHOOL RESOURCES BY TEACHER

Need assistance	Number of teachers	Percent of teachers
Yes	182	65.2
No	97	34.8
Total	279	100.0

TABLE 4.89

FREQUENCY DISTRIBUTION OF TEACHER'S NEED FOR OBTAINING INFORMATION ABOUT NEW TEACHING METHODS BY TEACHER

Need assistance	Number of teachers	Percent of teachers
Yes	173	61.8
No	107	38.2
Total	280	100.0

Obtaining Information about Instructional Materials

As shown in Table 4.90, approximately 60 percent of the teachers indicated a need for obtaining information about instructional materials while about 40 percent did not feel a need for this type of information.

TABLE 4.90

FREQUENCY DISTRIBUTION OF TEACHER'S NEED FOR OBTAINING INFORMATION ABOUT INSTRUCTIONAL MATERIALS BY TEACHER

Need assistance	Number of teachers	Percent of teachers
Yes	168	59.8
No	113	40.2
Total	281	100.0

Developing Skills to Use New Science Equipment and Facilities

Of the science teachers responding to this item, 54 percent indicated a need for assistance in developing skills to use new science equipment and facilities. Forty percent of the teachers did not need this assistance (Table 4.91).

TABLE 4.91

FREQUENCY DISTRIBUTION OF TEACHER'S NEED FOR ASSISTANCE IN DEVELOPING SKILLS TO USE NEW SCIENCE EQUIPMENT AND FACILITIES BY TEACHER

Need assistance	Number of teachers	Percent of teachers
Yes	150	54.0
No	128	46.0
Total	278	100.0

Obtaining Information about Recent Curriculum Developments

Of the science teachers responding to this item, 52.3 percent indicated a need for obtaining information about recent curriculum, while 47.7 did not need this assistance (Table 4.92).

TABLE 4.92

FREQUENCY DISTRIBUTION OF TEACHER'S NEED FOR OBTAINING INFORMATION ABOUT RECENT CURRICULUM DEVELOPMENTS BY TEACHER

Need assistance	Number of teachers	Percent of teachers
Yes	147	52.3
No	134	47.7
Total	281	100.0

Developing Local Curriculum Materials

Of the science teachers responding to this item, 50 percent indicated a need for assistance in developing local curriculum materials while the other half did not feel a need for this assistance (Table 4.93).

Obtaining Information about Films, TV and Radio Programs

Data on Table 4.94 show that 49.3 percent of teachers reporting, indicated a need for obtaining information about films, TV and radio programs while 50.7 percent did not need this assistance.

TABLE 4.93

FREQUENCY DISTRIBUTION OF TEACHER'S NEED FOR ASSISTANCE IN DEVELOPING LOCAL CURRICULUM MATERIALS BY TEACHER

Need assistance	Number of teachers	Percent of teachers
Yes	139	50.0
No	139	50.0
Total	278	100.0

TABLE 4.94

FREQUENCY DISTRIBUTION OF TEACHER'S NEED FOR OBTAINING INFORMATION ABOUT FILMS, TV AND RADIO PROGRAMS BY TEACHER

Need assistance	Number of teachers	Percent of teachers
Yes	137	49.3
No	141	50.7
Total	278	100.0

Implementing New Curriculum Projects

Approximately 48 percent of the science teachers checking this item indicated a need for assistance in implementing new curriculum projects, while 52.2 percent did not feel a need for this assistance (Table 4.95).

TABLE 4.95

FREQUENCY DISTRIBUTION OF TEACHER'S NEED FOR ASSISTANCE IN IMPLEMENTING NEW CURRICULUM PROJECTS BY TEACHER

Need assistance	Number of teachers	Percent of teachers
Yes	132	47.8
No	144	52.2
Total	276	100.0

Obtaining Information about Subject Matter

Approximately 42 percent of the science teachers reporting, indicated a need for obtaining information about subject matter, while 58.1 percent indicated they did not need this assistance (Table 4.96).

TABLE 4.96

FREQUENCY DISTRIBUTION OF TEACHER'S NEED FOR OBTAINING INFORMATION ABOUT SUBJECT MATTER BY TEACHER

Need assistance	Number of teachers	Percent of teachers
Yes	116	41.9
No	161	58.1
Total	277	100.0

Articulating Instruction across Classrooms within A Building and across Different Buildings

Data on Table 4.97 show that of the science teachers checking this item, 39.5 percent indicated a need for assistance in articulating instruction across classrooms within a building and across different buildings, while 60.5 percent indicated they did not need this assistance.

TABLE 4.97

FREQUENCY DISTRIBUTION OF TEACHER'S NEED FOR ASSISTANCE IN ARTICULATING INSTRUCTION ACROSS CLASSROOMS WITHIN A BUILDING AND ACROSS DIFFERENT BUILDINGS BY TEACHER

Need assistance	Number of teachers	Percent of teachers
Yes	109	39.5
No	167	60.5
Total	288	100.0

Using Manupulative or Hands-On Materials

As shown in Table 4.98,of the science teachers responding to this item, 35.1 percent showed a need for assistance in using manipulative or hand-on materials while 64.9 percent did not feel a need for this assistance.

Implementing Discovery/Inquiry Approach

Data on Table 4.99 show that 34.2 percent of science teachers reporting indicated a need for assistance in implementing discovery

Inquiry Approach, while 65.8 percent indicated they did not need this service.

TABLE 4.98

FREQUENCY DISTRIBUTION OF TEACHER'S NEED FOR ASSISTANCE IN USING MANIPULATIVE OR HANDS-ON MATERIALS BY TEACHER

Need assistance	Number of teachers	Percent of teachers
Yes	98	35.1
No	181	64.9
Total	279	100.0

TABLE 4.99

FREQUENCY DISTRIBUTION OF TEACHER'S NEED FOR ASSISTANCE IN IMPLEMENTING DISCOVERY/INQUIRY APPROACH BY TEACHER

Need assistance	Number of teachers	Percent of teachers
Yes	95	34.2
No	183	65.8
Total	278	100.0

Developing Skills to Use Audiovisual Aids

Approximately 20 percent of the teachers responding indicated a need for assistance in developing skills to use audiovisual aids, while 80.4 percent indicated they did not need this assistance (Table 4.100).

TABLE 4.100

FREQUENCY DISTRIBUTION OF TEACHER'S NEED FOR ASSISTANCE IN DEVELOPING SKILLS TO USE AUDIOVISUAL AIDS BY TEACHER

Need assistance	Number of teachers	Percent of teachers
Yes	54	19.6
No	221	80.4
Total	275	100.0

Summary

Results presented previously show that more than half of secondary school teachers (Grades 7-12) in the sample indicated a need for assistance in six areas. These areas are ranked in the following order:

1. Obtaining information about out-of-school resources
2. Obtaining information about new teaching methods
3. Obtaining information about instructional materials
4. Developing skills to use new science equipment and facilities
5. Obtaining information about recent curriculum developments
6. Developing local curriculum materials

Inservice Education Opportunities

Each science teacher was asked to indicate his or her need for more inservice training opportunities. Of the teachers responding to this item, 61.2 percent indicated a need for more inservice training opportunities. Approximately 39 percent indicated they did not need more inservice opportunities (Table 4.101).

TABLE 4.101

FREQUENCY DISTRIBUTION OF TEACHER'S NEED FOR INSERVICE TRAINING OPPORTUNITIES BY TEACHER

Need for inservice opportunities	Number of teachers	Percent of teachers
Yes	172	61.2
No	109	38.8
Total	281	100.0

Each teacher was also asked to indicate the types of inservice that would be of use. Percentages of various types of inservice education opportunities desired by science teachers in the sample are shown in Table 4.102. These opportunities are arranged in the table in order of percentages of need for the type of training as reported by teachers.

Of the science teachers responding to this item, 80.1 percent indicated a need for inservice opportunities in science teaching techniques, while 11.8 percent did not feel the need for this training. Inservice training in science content was indicated as desired by 65 percent of the teachers reporting as a need while approximately 35 percent indicated they did not need this training.

Thirty-eight percent of the teachers responding, indicated a need for inservice opportunities in change strategies while 62 percent indicated they did not need this training. Only 32 percent felt the need for inservice opportunities in evaluation strategies while 68 percent indicated they did not need this training.

TABLE 4.102

FREQUENCY DISTRIBUTION OF INSERVICE EDUCATION OPPORTUNITIES DESIRED BY TEACHER

Inservice opportunities	Yes		No		Total
	Number	Percent	Number	Percent	N
Science teaching techniques	137	80.1	34	11.8	171
Science content	112	65.1	60	34.9	172
Change strategies	65	38.0	106	62.0	171
Evaluation strategies	55	32.0	117	68.0	172

Results show that science teaching techniques was desired most frequently, science content next most frequently and change strategies third most frequently by science teachers in the sample.

Learning Activities

Ranking of Importance of Learning Activities

Teachers in the sample were asked to rank three teaching methods or learning activities as most important, next most important and third most important. Tables showing the ranks are arranged in order of percentages of those ranked most important. The data is presented in Table 4.103 through Table 4.109. Tables 4.110 through 4.117 are not discussed individually because the frequency distributions of the ranking for each of these learning activities are very low (less than 6 percent).

Lecture-Discussion

Lecture-discussion was ranked of most importance by 45.3 percent of the science teachers responding (Table 4.103). Approximately 18 percent ranked it next most important, and 14 percent third most important.

TABLE 4.103

FREQUENCY DISTRIBUTION OF IMPORTANCE OF LECTURE-DISCUSSION AS A LEARNING ACTIVITY AS RANKED BY TEACHERS

Rank of use	Number of teachers	Percent of total responses (N = 285)
Most	129	45.3
Next most	51	17.9
Third most	40	14.0
Not ranked	65	22.8
Total	285	100.0

Group Laboratory Activity

Group laboratory was ranked by 21 percent of the responding teachers as most important, 28.1 percent next most important, and 20.4 percent third most important (Table 4.104).

TABLE 4.104

FREQUENCY DISTRIBUTION OF IMPORTANCE OF GROUP LABORATORY AS A LEARNING ACTIVITY AS RANKED BY TEACHERS

Rank of use	Number of teachers	Percent of total responses (N = 285)
Most	60	21.0
Next most	80	28.1
Third most	58	20.4
Not ranked	87	30.5
Total	285	100.0

Lecture

Lecture was ranked by 9.1 percent of the responding teachers as most important, 6 percent next most important, and 4.6 percent third most important (Table 4.105).

Individual Laboratory Activity

Individual laboratory was ranked most important by 6.3 percent of the responding science teachers, 42.6 percent next most important, and 7.7 percent third most important (Table 4.106).

TABLE 4.105

FREQUENCY DISTRIBUTION OF IMPORTANCE OF LECTURE AS A LEARNING ACTIVITY AS RANKED BY TEACHERS

Rank of use	Number of teachers	Percent of total responses (N = 285)
Most	26	9.1
Next most	17	6.0
Third most	13	4.6
Not ranked	229	80.4
Total	285	100.0

TABLE 4.106

FREQUENCY DISTRIBUTION OF IMPORTANCE OF INDIVIDUAL LABORATORY AS A LEARNING ACTIVITY AS RANKED BY TEACHERS

Rank of use	Number of teachers	Percent of total responses (N = 285)
Most	18	6.3
Next most	36	12.6
Third most	22	7.7
Not ranked	209	73.4
Total	285	100.0

In-Class Written Assignments

In-class written assignments were ranked most important by 6.7 percent of the responding teachers, 12.6 percent next most important, and 17.2 percent third most important (Table 4.107).

TABLE 4.107

FREQUENCY DISTRIBUTION OF IMPORTANCE OF IN-CLASS WRITTEN ASSIGNMENTS AS A LEARNING ACTIVITY AS RANKED BY TEACHERS

Rank of use	Number of teachers	Percent of total responses (N = 285)
Most	19	6.7
Next most	36	12.6
Third most	49	17.2
Not ranked	181	63.5
Total	285	100.0

Instructional Films/Filmstrip

Instructional films/filmstrips were ranked by 3.5 percent of the responding teachers as most important, 6.7 percent next most important, and 14.4 percent third most important (Table 4.108).

Science Demonstrations

Science demonstrations were ranked most important by 3.2 percent of the responding reachers, 10.2 percent next most important, and 10.5 percent third most important (Table 4.109).

TABLE 4.108

FREQUENCY DISTRIBUTION OF IMPORTANCE OF INSTRUCTIONAL FILMS AS A LEARNING ACTIVITY AS RANKED BY TEACHERS

Rank of use	Number of teachers	Percent of total responses (N = 285)
Most	10	3.5
Next most	19	6.7
Third most	41	14.4
Not ranked	215	75.4
Total	285	100.0

TABLE 4.109

FREQUENCY DISTRIBUTIONS OF IMPORTANCE OF SCIENCE DEMONSTRATIONS AS A LEARNING ACTIVITY AS RANKED BY TEACHERS

Rank of use	Number of teachers	Percent of total responses (N = 285)
Most	9	3.2
Next most	29	10.2
Third most	30	10.5
Not ranked	217	76.1
Total	285	100.0

TABLE 4.110

FREQUENCY DISTRIBUTION OF IMPORTANCE OF AUTO-TUTORIAL INSTRUCTION AS A LEARNING ACTIVITY AS RANKED BY TEACHERS

Rank of use	Number of teachers	Percent of total responses (N = 285)
Most	5	1.8
Next most	0	0.0
Third most	5	1.8
Not ranked	275	96.4
Total	285	100.0

TABLE 4.111

FREQUENCY DISTRIBUTION OF IMPORTANCE OF PROGRAMED INSTRUCTION AS A LEARNING ACTIVITY AS RANKED BY TEACHERS

Rank of use	Number of teachers	Percent of total responses (N = 285)
Most	2	0.7
Next most	0	0.0
Third most	2	0.7
Not ranked	281	98.6
Total	285	100.0

TABLE 4.112

FREQUENCY DISTRIBUTION OF IMPORTANCE OF TELEVISED INSTRUCTION AS A LEARNING ACTIVITY AS RANKED BY TEACHERS

Rank of use	Number of teachers	Percent of total responses (N = 285)
Most	1	0.4
Next most	0	0.0
Third most	1	0.4
Not ranked	283	99.2
Total	285	100.0

TABLE 4.113

FREQUENCY DISTRIBUTION OF IMPORTANCE OF EXCURSIONS OR FIELD STUDIES AS A LEARNING ACTIVITY AS RANKED BY TEACHERS

Rank of use	Number of teachers	Percent of total responses (N = 285)
Most	0	0.0
Next most	0	0.0
Third most	4	1.4
Not ranked	281	98.6
Total	285	100.0

TABLE 4.114

FREQUENCY DISTRIBUTION OF IMPORTANCE OF SMALL GROUP DISCUSSION AS A LEARNING ACTIVITY AS RANKED BY TEACHERS

Rank of use	Number of teachers	Percent of total responses (N = 285)
Most	1	0.4
Next most	6	2.1
Third most	9	3.1
Not ranked	269	94.4
Total	285	100.0

TABLE 4.115

FREQUENCY DISTRIBUTION OF IMPORTANCE OF INDEPENDENT STUDY AS A LEARNING ACTIVITY AS RANKED BY TEACHERS

Rank of use	Number of teachers	Percent of total responses (N = 285)
Most	1	0.4
Next most	3	1.0
Third most	7	2.5
Not ranked	274	96.1
Total	285	100.0

TABLE 4.116

FREQUENCY DISTRIBUTION OF IMPORTANCE OF LIBRARY WORK AS A LEARNING ACTIVITY AS RANKED BY TEACHERS

Rank of use	Number of teachers	Percent of total responses (N = 285)
Most	0	0.0
Next most	0	0.0
Third most	3	1.1
Not ranked	282	98.9
Total	285	100.0

TABLE 4.117

FREQUENCY DISTRIBUTION OF IMPORTANCE OF GUEST SPEAKERS AS A LEARNING ACTIVITY AS RANKED BY TEACHERS

Rank of use	Number of teachers	Percent of total responses (N = 285)
Most	0	0.0
Next most	2	0.7
Third most	3	1.1
Not ranked	280	98.2
Total	285	100.0

Summary

Examination of the previous tables show that these science teachers indicated lecture-discussion, group laboratory activity, lecture, in-class written assignments, individual laboratory and to a lesser extent instructional films as the most important learning activities. Lecture-discussion was ranked as the most important learning activity.

Change

Science teachers were asked if they had been teaching during the 1970/71 school year at their same schools of 1979/80, and, if so, to indicate the major changes that had been made since 1971 in their science teaching. As shown in Table 4.118, about 58 percent of the teachers responding to this item reported that they were working in the same schools in 1970/71 school year.

TABLE 4.118

FREQUENCY DISTRIBUTION OF TEACHERS TEACHING DURING THE 1970/71 SCHOOL YEAR AT THE SAME SCHOOL OF 1979/80 BY TEACHER

Teaching in the same school	Number of teachers	Percent of teachers
Yes	167	58.2
No	120	41.8
Total	287	100.0

Data on Table 4.119 show that of the science teachers reporting 80.2 percent indicated that major changes had occurred since 1971 in their science teaching.

TABLE 4.119

FREQUENCY DISTRIBUTION OF TEACHERS' CHANGES IN CLASSROOM SCIENCE BY TEACHER

Having changes	Number of teachers	Percent of teachers
Yes	134	80.2
No	33	19.8
Total	167	100.0

Table 4.120 presents the percentages of major changes in classroom science programs. Major changes are arranged in the table in order of percentages of change in the classroom science programs. Examination of this table indicates that changed textbooks was the most frequent change in science programs which was reported by 82 percent of the teachers responding.

Revised courses was the next most frequent change which was reported by 76.1 percent of the teachers responding. Added courses was the third most frequent change which was reported by approximately 55 percent of the teachers responding. Developed new materials was the fourth most frequent change reported by 46.3 percent of science teachers responding. Eliminated courses was reported by approximately 33 percent of the teachers. Each of the other two changes were reported by less than 25 percent of the teachers responding to each item. Eliminated courses were reported by 32.8 percent, increased student course requirements in science by 23.1 percent and reduced student course requirements in science by 17.9 percent of the teachers responding.

TABLE 4.120

FREQUENCY DISTRIBUTION OF MAJOR CHANGES IN CLASSROOM SCIENCE BY TEACHER

Major changes	Yes		No		Total	
	Number of teachers	Percent of teachers	Number of teachers	Percent of teachers	Number of teachers	Percent of teachers
Changed textbooks	110	82.1	24	17.9	134	100.0
Revised courses	102	76.1	32	23.9	134	100.0
Added courses	73	54.5	61	45.5	134	100.0
Developed new materials locally	62	46.3	72	53.7	134	100.0
Eliminated courses	44	32.8	90	67.2	134	100.0
Increased student course requirements in science	31	23.1	103	76.9	134	100.0
Reduced student course requirements in science	24	17.9	110	82.1	134	100.0

Teachers were asked to rate their satisfaction with their science programs (Table 4.121). On a five point scale, 14.1 percent stated they were very satisfied. About 59 percent stated they were satisfied while 13.4 percent ranked their satisfaction at the middle of the scale (neutral). About 13 percent of the teachers marked their satisfaction with their science programs as below the middle of the scale.

TABLE 4.121

FREQUENCY DISTRIBUTION OF TEACHERS RANKING OF THEIR SATISFACTION WITH THEIR SCIENCE PROGRAMS BY TEACHER

Degree of satisfaction	Number of teachers	Percent of teachers
Very satisfied	40	14.1
Satisfied	168	59.4
Neutral	38	13.4
Dissatisfied	31	11.0
Very dissatisfied	6	2.1
Total	283	100.0
Mean		3.724

ATTITUDES TOWARD SCIENCE CURRICULUM AND INSTRUCTION

Principals and science teachers in the sample were asked to give a response for each item of the attitude questionaire to identify principals' and teachers' attitudes toward change in science curricula and school practices.

The first part of the decision making process presents how principals and teachers perceive the role of the selected groups or individuals in determining the science curriculum for schools.

This is followed by a p[illegible] concerned with changes in science curriculum and instruction.

The third part presents how principals and teachers feel toward the importance of science resources and different types of information.

The fourth part presents the degree of agreement or disagreement of principals and teachers with the federal support for science course improvement.

The fifth part is concerned with the components (objectives) of secondary school science education.

The sixth part on the barriers to change presents the opinion of principals and teachers on factors that may have a negative effect on the improvement of practices in science programs. This part also includes the attitude of principals and teachers toward tangible and intangible incentives.

Decision Making

Principals and science teachers in the sample were asked to rate the influence they had in determining the science curriculum for their buildings. They were also asked to rate the influence each of the other specific groups or individuals had in determining the school science curriculum.

Response options were (1) none, (2) some and (3) considerable. Percentages are presented for the total number of principals, or teachers checking each item. Data on Table 4.122 indicate that approximately 42 percent of the principals rated the influence they had in determining the science curriculum as considerable and 56.2 percent as some, while 46.4 percent of the science teachers rated their influence as considerable and 43.5 percent as some.

The attitudes of the principals and the teachers toward the influence each of the specific groups actually had in determining the school science program is discussed below. Means of the principal and teacher ratings are close in value.

State Department of Education

Data on Table 4.122 show that 27.4 percent of principals rated the influence of the state department of education as considerable and 62.1 percent as some, while 24 percent of teachers rated the influence of the state department of education as considerable and approximately 60 percent as some.

TABLE 4.122

FREQUENCY DISTRIBUTION OF THE RESPONSES OF THE PRINCIPALS AND THE TEACHERS REGARDING THE INFLUENCE THEY HAD IN DETERMINING THE SCIENCE CURRICULUM FOR THEIR BUILDINGS BY PRINCIPAL/TEACHER

Influence	Number of principals	Percent of principals	Number of teachers	Percent of teachers
Considerable	40	41.7	129	46.4
Some	54	56.2	121	43.5
None	2	2.1	28	10.1
Total	96	100.0	278	100.0
Mean		2.40		2.36
SD		0.53		0.66

District Superintendent

Seventy-one percent of the principals responding, rated the influence the district superintendents had in determining the science curriculum as some, 18.3 percent as considerable and approximately 11 percent as none. Percentages of teachers rating their influence as considerable was 23.5 percent, none was 24.2 percent, and some was 52.3 percent. (See Table 4.123).

Central Staff (Curriculum Coordinator or Supervisor)

Almost similar percentages of the principals and the teachers, felt that the curriculum coordinators or supervisors had considerable influence on school science curriculum (36.2 percent and 37.6 percent respectively), while 9.6 percent of principals felt that the central staff had no influence compared with 15.1 percent of teachers (Table 4.123).

School Board

Nearly the same percentage of the principals and the teachers believed that the school board had considerable influence in determining the school science curriculum (17 percent and 18.4 percent respectively), while 11.7 percent of the principals and 24.5 percent of the teachers believed that the school board had no influence (Table 4.123).

Principal

As shown in Table 4.123, 38.1 percent of the principals perceived their influence as considerable, 59.8 as some and 2.1 percent as none, while 21.2 percent of teachers rated the influence of principals as considerable, 65.4 as some and 13.4 percent as none.

Examination of responses of the principals in Tables 4.122 and 4.123 regarding the influence principals had on science curriculum shows that both of the two responses are almost similar.

Department Chairperson

Approximately 69 percent of the principals responding, believed that the department chairperson had considerable influence, compared with 39.4 percent of the teachers. Twenty-eight percent of principals believed that the department chairman had some influence compared with 49.5 percent of teachers (Table 4.123).

TABLE 4.123

FREQUENCY DISTRIBUTION OF THE RESPONSES OF THE PRINCIPALS AND THE TEACHERS REGARDING THE INFLUENCE EACH OF THE SPECIFIC GROUPS OR INDIVIDUALS HAD IN DETERMINING THE SCIENCE CURRICULUM BY PRINCIPAL/TEACHER

Group/ individual	Principals								Teachers							
	Considerable		Some		None		Total	Mean	Considerable		Some		None		Total	Mean
	N	%	N	%	N	%	N		N	%	N	%	N	%	N	
Department of education	26	27.4	59	62.1	10	10.5	95	2.17	68	24.0	169	59.7	46	16.3	283	2.08
Superintendent*	17	18.3	66	71.0	10	10.8	93	2.08	66	23.5	147	52.3	68	24.2	281	1.99
Central staff**	34	36.2	51	54.3	9	9.6	94	2.27	105	37.6	132	47.3	42	15.1	279	2.23
School board	16	17.0	67	71.3	11	11.7	94	2.05	52	18.4	161	57.1	69	24.5	282	1.94
Principal	37	38.1	58	59.8	2	2.1	97	2.36	60	21.2	185	65.4	38	13.4	283	2.08
Department chairman	64	68.8	26	28.0	3	3.2	93	2.66	110	39.4	138	49.5	31	11.1	279	2.28
Teachers	69	71.1	25	25.8	3	3.1	97	2.68	145	51.1	118	41.5	21	7.4	284	2.43
Students	11	11.3	59	60.8	27	27.8	97	1.84	18	6.5	144	51.8	116	41.7	278	1.65
Parents	7	7.4	60	63.8	27	28.7	94	1.79	8	2.9	126	46.3	138	50.7	272	1.52

*District Superintendent

**Curriculum Coordinator or Supervisor

Teachers

As shown in Table 4.123, 71.1 percent of the principals felt that the teachers had considerable influence on the science curriculum, compared with 51.1 percent of the teachers. Approximately 26 percent of the principals rated teachers influence as some and 3.1 percent as none while approximately 42 percent of the teachers rated their influence as some and 7.4 percent as none. Examination of responses of the teachers in Tables 4.122 and 4.123 regarding the influence the teachers had on science curriculum show that responses to the two items are very close.

Students

A small percentage of the principals (11.3 percent) and the teachers (6.5 percent) indicated that students had considerable influence on school science curriculum, while 27.8 percent of the principals and 41.7 percent of the teachers believed the students had no influence (Table 4.123).

Parents

Data on Table 4.123 show that a small percentage of the principals (7.4 percent) and the teachers (2.9 percent) reported that parents had considerable influence on school science curriculum while approximately 29 percent of the principals and 50.7 percent of teachers felt the parents had no influence.

Principals and teachers in the sample were asked to rate the influence they should have in determining the science curriculum for their buildings. They were also asked to rate the influence each of the specific groups or individuals should have in determining the school science curriculum.

Data on Table 4.124 indicate that 48.4 percent of the principals and 76.4 percent of the teachers responding rated the influence they should have in determining the science curriculum as considerable. Approximately 51 percent of the principals and 23.3 percent of the teachers felt they should have some influence.

The influence each of the specific groups or individuals should have in determining the school science curriculum is presented in Table 4.125. Groups and individuals rated by more than 20 percent of the principals or the teachers to have considerable influence are discussed individually. Means of the principal and teacher responses were very close.

Central Staff (Curriculum Coordinator or Supervisor)

Approximately 40 percent of the principals and 31 percent of the teachers responding felt that the curriculum coordinators or supervisors should have considerable influence on school science curriculum. Also,54.2 percent of the principals and 63.1 percent of the teachers indicated that the central staff should have some influence. A small percentage of the principals and the teachers (6 percent) did not believe that curriculum coordinators or supervisors should have any influence in determining the school science curriculum.

Principal

Of the principals responding to this item, 49.0 percent felt that they should have considerable influence, compared with 16.5 percent of teachers. Fifty percent of the principals felt that principals should have some influence compared with 73 percent of the teachers.

Examination of both responses of the principals in Tables 4.124 and 4.125 regarding the influence principals should have on science curriculum shows that the two responses are quite similar.

Department Chairperson

Approximately 75 percent of the principals and 54 percent of the teachers felt that the department chairperson should have considerable influence. The remaining 25 percent of the principals indicated that the department chairperson should have some influence; 42.6 percent of the teachers agreed.

Teachers

The principals and the teachers responded quite similarly regarding the influence science teachers should have in determining the science curriculum. A large percentage of each of the two groups (approximately 77 percent) indicated that the teachers should have considerable influence. The remaining 23 percent of the two groups felt that the teachers should have some influence.

Examination of both responses of the teachers in Tables 4.124 and 4.125 regarding the influence teachers should have in determining science curriculum shows that both of the responses are close.

Data on Table 4.125, p. 291, show that between 8.1 and 19.4 percent of principals and teachers felt that other groups or individuals (state department of education, district superintendent, school board, students and parents) should have considerable influence in determining the school science curriculum.

TABLE 4.124

FREQUENCY DISTRIBUTION OF THE RESPONSES OF PRINCIPALS AND TEACHERS REGARDING THE INFLUENCE THEY SHOULD HAVE IN DETERMINING THE SCIENCE CURRICULUM FOR THEIR BUILDINGS BY PRINCIPAL/TEACHER

Influence	Number of principals	Percent of principals	Number of teachers	Percent of teachers
Considerable	46	48.4	210	76.4
Some	48	50.5	64	23.3
None	1	1.1	1	0.4
Total	100	100.0	288	100.0
Mean		2.47		2.76
SD		0.52		0.44

TABLE 4.125

FREQUENCY DISTRIBUTION OF THE RESPONSES OF PRINCIPALS AND TEACHERS REGARDING THE INFLUENCE EACH OF THE SPECIFIC GROUPS OR INDIVIDUALS SHOULD HAVE IN DETERMINING THE SCIENCE CURRICULUM BY PRINCIPAL/TEACHER

Group/ individual	Principals								Teachers							
	Considerable		Some		None		Total	Mean	Considerable		Some		None		Total	Mean
	N	%	N	%	N	%	N		N	%	N	%	N	%	N	
Department of education	16	16.0	71	71.0	13	13.0	100	2.03	32	11.2	222	77.6	32	11.2	286	2.00
Superintendent*	19	19.4	69	70.4	10	10.2	98	2.09	31	10.9	203	71.5	50	17.6	284	1.93
Central staff**	38	39.6	52	54.2	6	6.2	96	2.32	87	30.9	178	63.1	17	6.0	282	2.25
School board	15	15.0	72	72.0	13	13.0	100	2.02	23	8.1	195	68.4	67	23.5	285	1.85
Principal	49	49.0	50	50.0	1	1.0	100	2.48	47	16.5	208	73.0	30	10.5	285	2.06
Department chairman	71	74.7	24	25.3	0	0.0	95	2.75	154	54.2	121	42.6	9	3.2	284	2.51
Teachers	76	76.8	23	23.2	0	0.0	99	2.77	219	76.6	66	23.1	1	0.3	286	2.76
Students	18	18.0	77	77.0	5	5.0	100	2.13	51	18.0	197	69.4	36	12.7	284	2.05
Parents	10	10.0	79	79.0	11	11.0	100	1.99	17	6.0	218	77.6	46	16.4	281	1.90

*District Superintendent

**Curriculum Coordinator or Supervisor

Summary

Principals and teachers felt that teachers had the most influence in determining the science curriculum for their schools, and the department chairperson had the next most considerable influence. Principals believed that they had the third most influence, while the teachers felt that the central staff (curriculum coordinator or supervisor) had the third most influence. Principals felt that the central staff had the fourth most influence in determining the science curriculum in their schools.

Concerning the influence each of the specific groups or individuals should have in determining the science curriculum, results showed that principals and teachers ratings for the four groups that should have considerable influence in determining were similar to what they believed existed.

Changes in Science Curriculum and Instruction

Principals and science teachers in the sample were asked to rate their general attitude toward the introduction of new practices and materials in their schools. They were also asked to specify their responses that best described the general attitude of each of the specific groups or individuals toward the introduction of new practices and materials in their schools. Response options were (1) very negative, (2) negative, (3) neutral, (4) positive, and (5) very positive. Percentages of each group are presented with regard to the total number of principals or teachers responding to each item.

Data on Table 4.126 indicate that 25.5 percent of the principals responding rated their attitude toward the introduction of new practices and materials in their schools as very positive, 72.3 percent as positive and 2.1 percent as neutral while 20.4 percent of the science teachers rated their attitude as very positive, 64.6 percent as positive and 12.5 percent as neutral. Examination of the data show that high percentages of the principals and the teachers responding had positive attitudes toward the introduction of new practices and materials in their schools.

TABLE 4.126

FREQUENCY DISTRIBUTION OF THE PRINCIPALS' AND TEACHERS' ATTITUDE TOWARD THE INTRODUCTION OF NEW PRACTICES AND MATERIALS IN THEIR SCHOOLS BY PRINCIPAL/TEACHER

Attitude	Number of principals	Percent of principals	Number of teachers	Percent of teachers
Very positive	24	25.5	57	20.4
Positive	68	72.3	181	64.6
Neutral	2	2.1	35	12.5
Negative	0	0.0	5	1.8
Very negative	0	0.0	2	0.7
Total	94	100.0	280	100.0
Mean		4.23		4.02
SD		0.47		0.68

State Department of Education

Data on Table 4.127, p. 294 , show that 6.3 percent of the principals rated the attitude of the state department of education as

TABLE 4.127

FREQUENCY DISTRIBUTION OF THE RESPONSES OF PRINCIPALS AND TEACHERS REGARDING THE ATTITUDES EACH OF THE SPECIFIC GROUPS OR INDIVIDUALS HAS TOWARD THE INTRODUCTION OF NEW PRACTICES AND MATERIALS IN THEIR SCHOOLS BY PRINCIPAL/TEACHER

Group/ individual	Principals											
	Very Positive		Positive		Neutral		Negative		Very Negative		Total	Mean
	N	%	N	%	N	%	N	%	N	%	N	
Department of education	6	6.3	50	52.1	37	38.5	3	3.1	0	0.0	96	3.62
Superintendent*	16	16.3	59	60.2	20	20.4	3	3.1	0	0.0	98	3.90
Central staff**	24	25.3	58	61.1	12	12.6	1	1.1	0	0.0	95	4.11
School board	10	10.2	57	58.2	27	27.6	4	4.1	0	0.0	98	3.75
Principal	29	29.6	67	68.4	2	2.0	0	0.0	0	0.0	98	4.28
Department chairman	35	37.2	54	57.4	4	4.3	1	1.1	0	0.0	94	4.31
Teachers	35	35.7	54	55.1	6	6.1	3	3.1	0	0.0	98	4.24
Students	11	11.5	50	52.1	34	35.4	1	1.0	0	0.0	96	3.74
Parents	8	8.3	39	40.6	46	47.9	3	3.1	0	0.0	96	3.54

*District Superintendent

**Curriculum Coordinator or Supervisor

TABLE 4.127 (CONTINUED)

Group/ individual	Teachers											
	Very Positive		Positive		Neutral		Negative		Very Negative		Total	Mean
	N	%	N	%	N	%	N	%	N	%	N	
Department of education	14	5.1	103	37.5	149	54.2	9	3.3	0	0.0	275	3.44
Superintendent*	25	9.1	120	43.5	105	38.0	24	8.7	2	0.7	276	3.51
Central staff**	52	19.3	132	49.1	71	26.4	14	5.2	0	0.0	269	3.83
School board	15	5.4	100	36.1	124	44.8	32	11.6	6	2.2	277	3.31
Principal	40	14.3	157	56.3	60	21.5	20	7.2	2	0.7	279	3.76
Department chairman	87	31.2	144	51.6	36	12.9	9	3.2	3	1.1	279	4.09
Teachers	72	25.5	157	55.7	39	13.8	10	3.5	4	1.4	282	4.00
Students	34	12.1	120	42.7	114	40.6	10	3.6	3	1.1	281	3.61
Parents	11	3.9	85	30.5	163	58.4	16	5.7	4	1.4	279	3.30

*District Superintendent

**Curriculum Coordinator or Supervisor

very positive, 52.1 percent as positive and 38.5 percent as neutral, while 5.1 percent of the science teachers rated the attitude of the state department of education toward the introduction of new practices and materials as very positive, 37.5 percent as positive and 54.2 percent as neutral. Very few of the principals and the teachers felt that the state department of education had negative attitudes.

District Superintendent

As shown in Table 4.127, p. 294, 16.3 percent of the principals felt that the district superintendent had a very positive attitude toward the introduction of new practices and materials compared with 5.1 percent of the science teachers. Also, 60.2 percent of the principals believed that the district superintendents had positive attitudes compared with 43.5 percent of the teachers. Very few of the principals and the teachers believed that the district superintendent had a very negative or negative attitude toward the introduction of new practices and materials.

Central Staff (Curriculum Coordinator or Supervisor)

Data on Table 4.127 show that 25.3 percent of the principals rated the attitude of the curriculum coordinator or supervisor as very positive, 61.1 percent as positive and 12.6 percent as neutral, while 19.3 percent of the science teachers rated the attitude of the central staff as very positive, 49.1 percent as positive and 26.4 percent as neutral. Few of the principals and teachers felt that the curriculum coordinator or supervisor had a very negative or negative attitude toward the introduction of new practices and materials.

School Board

As shown in Table 4.127, p. 294, 10 percent of principals rated the attitude of the school board as very positive, 58.2 percent as positive and 27.6 percent as neutral, while 5.4 percent of the science teachers rated the attitude of the school board as very positive, 36.1 percent as positive and 44.8 percent as neutral. Very few of the principals and the teachers believed that the school board had very negative or negative attitudes toward the introduction of new practices and materials.

Principal

As shown in Table 4.127, p. 294, 29.6 percent of the principals considered their attitude toward the introduction of new practices and materials as very positive, 68.4 percent as positive and 2 percent as neutral, while 14.3 percent of the teachers rated the principals' attitude as very positive, 56.3 percent as positive and 21.5 as neutral.

Examination of both responses of the principals in Tables 4.126 and 4.127 regarding the principals' attitude toward the introduction of new practices and materials shows that both of the responses are close.

Department Chairperson

Data on Table 4.127, p. 294, show that 37.2 percent of the principals considered the attitude of the department chairman toward the introduction of new practices and materials as very positive, 57.4 percent as positive and 4.3 percent as neutral, while 31.2 percent of the teachers rated the department chairpersons attitude as very positive, 51.6 percent as positive and 12.9 percent as neutral. Few of the principals and teachers felt that department chairpersons had a very negative or negative attitude toward the introduction of new practices and materials.

Teachers

Approximately 36 percent of the principals rated the attitude of the teachers as very positive, 55.1 percent as positive, 6.1 percent as neutral and 3.1 percent as negative, while 25.5 percent of the teachers considered their attitude as very positive, 55.7 percent as positive, 13.8 percent as neutral and 3.5 percent as negative.

Examination of both responses of the teachers in Tables 4.126 and 4.127 regarding the teachers' attitude toward the introduction of new practices and materials shows that the responses are very similar.

Students

Approximately 12 percent of the principals rated the attitude of the students as very positive, 52.1 percent as positive, 35.4 percent as neutral and 1.0 percent as negative while 12.1 percent of the teachers rated the students' attitude as very positive, 42.7 percent as positive, 40.6 percent as neutral and 3.6 percent as negative.

Parents

Data on Table 4.127, p. 294 , show that 8.3 percent of the principals rated the parents' attitude toward the introduction of new practices and materials as very positive, 40.6 percent as positive, 47.9 percent as neutral and 3.1 percent as negative, while 3.9 percent of the teachers rated the parents' attitude as very positive, 30.5 percent as positive, 58.4 percent as neutral and 5.7 as negative.

Summary

Means of all principal ratings were above 3.5 regarding attitudes toward new practices and materials; this indicated they felt all groups had positive attitudes.

Means of all teacher ratings were above 3.3 regarding attitudes toward new practices and materials; this indicated they felt all groups had positive attitudes.

Principals and teachers felt that department chairpersons had the most positive attitudes toward the introduction of new practices and materials, and teachers had the next most positive. Principals and teachers differed in rating the attitude of principals toward the introduction of new practices and materials. Principals believed that they had the third most positive attitude, while teachers felt that the central staff (curriculum coordinator or supervisor) had the third most positive attitude. Principals felt that the central staff had the fourth most positive attitude toward the introduction of new practices and materials.

Resources

Local, State and Federal Funds

Principals and science teachers in the sample were asked to rate what they believe should be spent from local, state and federal funds on new science materials and programs compared to current spending. Response options were (1) much less, (2) less, (3) some, (4) more and (5) much more.

Data on Table 4.128 show that 10.1 percent of the principals responding believed that much more should be spent from local funds on new science materials and programs, compared with 23.7 percent of the teachers. Also 43.4 percent of the principals believed that more should be spent from local funds, 45.5 percent the same, and 1.0 percent less; 51.2 percent of the teachers believed that more should be spent, 24 percent the same, and 1.1 percent less (Table 4.128).

About 22 percent of the principals responding believed that much more should be spent from state funds on new science materials and programs, compared with 26.8 percent of the teachers. About 42 percent of the principals believed that more should be spent and 35.7 percent the same; 52.1 percent of the teachers believed that more should be spent and 19.4 percent the same.

About 19 percent of the principals believed that much more should be sepnt from federal funds on new science materials and programs, compared with 24.5 percent of the teachers. About 29 percent of the principals believed that more should be spent, 41.2

percent the same, 5.2 percent less and 6.2 percent much less; about 44 percent of the science teachers believed that more should be spent and 24.5 percent the same, 4.3 percent less and 2.8 percent much less.

Summary

A majority of both principals and teachers felt more funds were needed from all sources for science materials and programs. Teachers had higher means and fewer felt that funds should remain the same.

Science Equipment and Supplies

Principals and science teachers in the sample were asked to specify how much additional science equipment and supplies were needed in their schools. Response options were (1) no more, (2) somehwat more, and (3) much more. Percentages of each group are presented in Table 4.129 with regard to the total number of principals or teachers checking this item.

Data on Table 4.129 reveal that 12.2 percent of the principals felt that much more additional science equipment and supplies were needed in their schools, compared with 37.5 percent of the teachers. Approximately 83 percent of the principals perceived that somewhat more additional science equipment and supplies were needed, and 5.1 percent no more while 58.6 percent of the teachers believed that somewhat more additional science equipment and supplies were needed, and 3.9 percent no more.

TABLE 4.128

FREQUENCY DISTRIBUTION OF THE RESPONSES OF THE PRINCIPALS AND THE TEACHERS REGARDING WHAT SHOULD BE SPENT ON NEW SCIENCE MATERIALS AND PROGRAMS COMPARED TO CURRENT SPENDING BY PRINCIPAL/TEACHER

Type of funds	Principals												Teachers											
	Much more		More		Same		Less		Much less		Total	Mean	Much more		More		Same		Less		Much less		Total	Mean
	N	%	N	%	N	%	N	%	N	%	N		N	%	N	%	N	%	N	%	N	%	N	
From local funds	10	10.1	43	43.4	45	45.5	1	1.0	0	0.0	99	3.63	67	23.7	145	51.2	68	24.0	3	1.1	0	0.0	283	3.98
From state funds	22	22.4	41	41.8	35	35.7	0	0.0	0	0.0	98	3.87	76	26.8	148	52.1	55	19.4	3	1.1	2	0.7	284	4.03
From federal funds	18	18.6	28	28.9	40	41.2	5	5.2	6	6.2	97	3.45	69	24.5	124	44.0	69	24.5	12	4.3	8	2.8	282	3.83

Much more = 5

More = 4

Same = 3

Less = 2

Much less = 1

TABLE 4.129

FREQUENCY DISTRIBUTION OF THE RESPONSES OF THE PRINCIPALS AND THE TEACHERS REGARDING HOW MUCH ADDITIONAL SCIENCE EQUIPMENT AND SUPPLIES WERE NEEDED IN SCHOOLS BY PRINCIPAL/TEACHER

Need for equipment and supplies	Number of principals	Percent of principals	Number of teachers	Percent of teachers
Much More	12	12.2	107	37.5
Somewhat more	81	82.7	167	58.6
No more	5	5.1	11	3.9
Total	100	100.0	288	100.0
Mean		2.07		2.34
SD		0.41		0.55

Much More = 3

Somewhat more = 2

No more = 1

Sources of Information

Principals and science teachers in the sample were given a list of possible sources of information about new practices and materials in science education and asked to rate the usefulness of each. These information sources were classified in five categories:

A. Person-to-Person Communication

B. Printed Communication

C. Formal Courses and Inservice Education

D. Mass Media

E. Meetings of Professional Organizations

Data are presented in Tables 4.130 through 4.134. Percentages of each group are presented with regard to the total number of principals or teachers responding to each item. Response options were: (1) not useful, (2) useful and (3) very useful.

Each of the sources rated by more than 20 percent of the principals or the teachers as a very useful source of information is presented individually. Other sources of information are presented in Tables 4.130 through 4.134

A. Person-to-Person Communication Contact

Teachers

Data on Table 4.130 show that approximately 61 percent of the principals rated teachers in the same building as a very useful source of information about new practices and materials in science education. Few of the principals perceived teachers outside the school within or outside the school district as a very useful source of information (7.1 percent for teachers within school district, and 10.3 percent for teachers outside school district).

Approximately 29 percent of the teachers considered other teachers in the same building as a very useful source of information about new practices and materials in science education. Lower percentages of teachers perceived other teachers within or outside the school district as a very useful source of information (12.5 percent for teachers within school district, and 15.4 outside the school district).

Curriculum Specialists

While 34.4 percent of the principals considered curriculum specialists within the school district to be very useful sources of information, only 15.1 percent of science teachers perceived curriculum specialists within the school district very useful as a source of information.

Approximately 10 percent of the principals, and 5.5 percent of teachers rated curriculum specialists outside the school district but not from state department as very useful sources of information about new practices and materials (Table 4.130).

B. Printed Communication

Professional Journals and Periodicals

As shown in Table 4.131, professional journals and

TABLE 4.130

FREQUENCY DISTRIBUTION OF THE RESPONSES OF THE PRINCIPALS AND THE TEACHERS REGARDING THE UTILITY OF PERSON-TO-PERSON COMMUNICATION AS SOURCES OF INFORMATION ABOUT NEW PRACTICES AND MATERIALS IN SCIENCE EDUCATION BY PRINCIPAL/TEACHER

Sources of information	Principals								Teachers							
	Very useful		Useful		Not useful		Total	Mean	Very useful		Useful		Not useful		Total	Mean
	N	%	N	%	N	%	N		N	%	N	%	N	%	N	
PERSON-TO-PERSON COMMUNICATION CONTACT WITHIN																
1. The Building																
a. Teachers in school	60	60.6	35	35.4	4	4.0	99	2.57	82	28.8	176	61.8	27	9.5	285	2.19
b. Principal in school									22	7.9	133	47.5	125	44.6	280	1.63
2. The School District (Other than the building)																
a. Teachers outside the school but within school district	7	7.1	67	68.4	24	24.5	98	1.83	35	12.5	158	56.2	88	31.3	281	1.81
b. Principals outside the school but within the school district	9	9.2	59	60.2	30	30.6	98	1.79	1	0.4	55	20.4	214	79.3	270	1.21
c. Curriculum specialists within the school district	33	34.4	45	46.9	18	18.8	96	2.16	41	15.1	109	40.1	122	44.9	272	1.70
d. Other professionals*	12	12.4	62	63.9	23	23.7	97	1.89	18	6.5	137	49.5	122	44.0	277	1.63

*Other professionals within the school district

TABLE 4.130(CONTINUED)

Sources of information	Principals								Teachers							
	Very useful		Useful		Not useful		Total	Mean	Very useful		Useful		Not useful		Total	Mean
	N	%	N	%	N	%	N		N	%	N	%	N	%	N	
3. Outside The School District																
a. Teachers outside the school district	10	10.3	56	57.7	31	32.0	97	1.78	43	15.4	142	50.9	94	33.7	279	1.82
b. Principals outside the school district	9	9.3	59	60.8	29	29.9	97	1.79	3	1.1	45	16.7	221	82.2	269	1.19
c. State department personnel	6	6.2	67	69.1	24	24.7	97	1.81	6	2.2	86	31.4	182	66.4	274	1.36
d. Curriculum specialists outside the school district but not from state department	9	9.5	57	60.0	29	30.5	95	1.79	15	5.5	109	39.8	150	54.7	274	1.51
e. Textbook sales representatives	2	2.1	59	60.8	36	37.1	97	1.65	23	8.2	132	46.8	127	45.0	282	1.63
f. College professors	8	8.3	51	53.1	37	38.5	96	1.70	53	19.1	142	51.1	83	29.9	278	1.89
g. Science project and materials developers	11	11.5	61	63.5	24	25.0	96	1.87	34	12.4	164	59.9	76	27.7	274	1.85

Very useful = 3 Useful = 2 Not useful = 1

periodicals were considered a very useful source of information by 31.3 percent of the principals and 40 percent of the teachers responding to this item. Also, approximately 67 percent of the principals and 56.1 percent of the teachers rated professional journals and periodicals useful as a source of information about new practices and materials in science education.

Textbooks and Other Books

While approximately 46 percent of the teachers considered textbooks and other books to be very useful sources of information, about 19 percent of the principals perceived textbooks and other books as very useful sources of information. However, approximately 74 percent of the principals and 51.6 percent of the teachers rated textbooks and other books as a useful source of information in science education (Table 4.131).

Bulletins and Newsletters

Bulletins and newsletters were considered a very useful source of information by approximately 27 percent of the principals and the teachers. Also 69.4 percent of the principals and 60.4 percent of the teachers responding perceived bulletins and newsletters as useful sources of information about new practices and materials in science education.

C. Formal Courses and Inservices Education

TABLE 4.131

FREQUENCY DISTRIBUTION OF THE RESPONSES OF THE PRINCIPALS AND THE TEACHERS REGARDING THE UTILITY OF PRINTED COMMUNICATION AS SOURCES OF INFORMATION ABOUT NEW PRACTICES AND MATERIALS IN SCIENCE EDUCATION BY PRINCIPAL/TEACHER

Sources of information	Principals								Teachers							
	Very useful		Useful		Not useful		Total	Mean	Very useful		Useful		Not useful		Total	Mean
	N	%	N	%	N	%	N		N	%	N	%	N	%	N	
PRINTED COMMUNICATION																
1. Professional journals and periodicals	31	31.3	66	66.7	2	2.0	99	2.29	114	40.0	160	56.1	11	3.9	285	2.36
2. Textbooks and other books	19	19.4	72	73.5	7	7.1	98	2.12	130	45.9	146	51.6	7	2.5	283	2.44
3. Bulletins and newsletters	26	26.5	68	69.4	4	4.1	98	2.26	78	27.4	172	60.4	35	12.3	285	2.15

Very useful = 3

Useful = 2

Not useful = 1

Formal Courses

Regular College Courses and Workshops

While approximately 36 percent of the teachers considered regular college courses and workshops to be very useful sources of information, only 20.6 percent of the principals responding perceived regular college courses and workshops very useful as a source of information. However, 64.9 percent of the principals considered regular college courses and workshops useful as a source of information compared with 54.3 percent of the teachers (Table 4.132).

Special College Courses and Workshops (Designed in Cooperation with Local or Regional Groups Especially for Them)

Data on Table 4.132 show that the percent of the principals (39.8 percent) rating special college courses and workshops very useful was similar to that of the teachers (42.1 percent). Also, 50 percent of the principals and approximately 47 percent of the teachers rated these special courses and workshops as useful sources of information about new practices and materials in science education.

Inservice Programs

Local District Inservice Programs (Seminars, Workshops, Etc.)

As shown in Table 4.132, 37.4 percent of principals rated local inservice programs as very useful while 16.8 percent of the teachers perceived local inservice programs very useful as a source of information. Approximately 51 percent of the principals considered local inservice programs useful as a source of information about new practices and materials compared with 54.3 percent of the teachers.

TABLE 4.132

FREQUENCY DISTRIBUTION OF THE RESPONSES OF THE PRINCIPALS AND THE TEACHERS REGARDING THE UTILITY OF FORMAL COURSES AND INSERVICE EDUCATION AS SOURCES OF INFORMATION ABOUT NEW PRACTICES AND MATERIALS IN SCIENCE EDUCATION BY PRINCIPAL/TEACHER

Sources of information	Principals								Teachers							
	Very useful		Useful		Not useful		Total	Mean	Very useful		Useful		Not useful		Total	Mean
	N	%	N	%	N	%	N		N	%	N	%	N	%	N	
FORMAL COURSES AND INSERVICES EDUCATION																
1. Formal Courses																
a. Regular college courses and workshops	20	20.6	63	64.9	14	14.4	97	2,06	100	35.5	153	54.3	29	10.3	282	2.25
b. Special college courses and workshops*	38	38.8	49	50.0	11	11.2	98	2.28	117	42.1	129	46.4	32	11.5	278	2.30
2. Inservice Programs																
a. Local district inservice programs**	37	37.4	50	50.5	12	12.1	99	2.25	47	16.8	152	54.3	81	28.9	280	1.88
b. County or intermediate unit inservice programs***	18	18.4	54	55.1	26	26.5	98	1.92	34	12.7	103	38.6	130	48.7	267	1.64
c. State inservice programs****	9	9.2	63	64.3	26	26.5	98	1.83	35	12.7	112	40.7	128	46.5	275	1.66
d. NSF programs*****	32	32.7	53	54.1	13	13.3	98	2.18	126	46.5	97	35.8	48	17.7	271	2.29

*Special college courses and workshops (designed in cooperation with local or regional groups especially for them)

**Local district inservice programs (seminars, workshops, etc.)

***County or intermediate unit inservice programs (seminars, workshops, etc.)

****State inservice programs (seminars, workshops, etc.)

*****National Science Foundation (NSF) or other federally-sponsored inservice programs (courses, seminars, workshops, etc.)

Very useful = 3 Useful = 2 Not useful = 1

National Science Foundation (NSF) or other Federally-Sponsored Inservice Programs (Courses, Seminars, Workshops, Etc.)

Data on Table 4.132 indicate that the NSF-sponsored inservice programs were considered a very useful source of information by approximately 33 percent of the principals and 46.5 percent of the teachers. Also, 54.1 percent of the principals considered the NSF inservice activities as useful sources of information about new practices and materials in science education compared with 35.8 percent of the teachers.

D. Mass Media

Public TV (Including Instructional TV)

Data on Table 4.133 show that 28.4 percent of the teachers checking this item rated the public TV as a very useful source of information compared with 9.2 percent of the principals.

Public TV was also considered by 62.2 percent of the principals and 57.8 percent of the teachers useful as a source of information about new practices and materials in science education.

E. Meetings of Professional Organizations

National Professional Organizations

As shown in Table 4.134, the percentage of the principals rating the national professional organizations as a very very useful source of information appears to be almost similar to that of the teachers (17.3 percent for principals

TABLE 4.133

FREQUENCY DISTRIBUTION OF THE RESPONSES OF THE PRINCIPALS AND THE TEACHERS REGARDING THE UTILITY OF THE MASS MEDIA AS SOURCES OF INFORMATION ABOUT NEW PRACTICES AND MATERIALS IN SCIENCE EDUCATION BY PRINCIPAL/TEACHER

Sources of information	Principals								Teachers							
	Very useful		Useful		Not useful		Total	Mean	Very useful		Useful		Not useful		Total	Mean
	N	%	N	%	N	%	N		N	%	N	%	N	%	N	
MASS MEDIA																
1. TV																
a. Public TV (including instructional TV)	9	9.2	61	62.2	28	28.6	98	1.80	80	28.4	163	57.8	39	13.8	282	2.15
b. Commercial TV	2	2.0	47	48.0	49	50.0	98	1.52	17	6.1	144	52.0	116	41.9	277	1.64
2. Radio																
a. Public radio (including instructional radio)	3	3.1	39	40.6	54	56.3	96	1.47	8	2.9	57	20.8	209	76.3	274	1.27
b. Commercial radio	1	1.0	35	36.1	61	62.9	97	1.38	4	1.5	47	17.3	221	81.3	272	1.20
3. Newspapers	9	9.1	68	68.7	22	22.2	99	1.87	39	13.9	198	70.5	44	15.7	281	1.98
4. General Magazines	4	4.2	69	72.6	22	23.2	95	1.81	43	15.3	195	69.4	43	15.3	281	2.00

Very useful = 3

Useful = 2

Not useful = 1

TABLE 4.134

FREQUENCY DISTRIBUTION OF THE RESPONSES OF THE PRINCIPALS AND THE TEACHERS REGARDING THE UTILITY OF THE MEETINGS OF PROFESSIONAL ORGANIZATIONS ABOUT NEW PRACTICES AND MATERIALS IN SCIENCE EDUCATION BY PRINCIPAL/TEACHER

Sources of information	Principals								Teachers							
	Very useful		Useful		Not useful		Total	Mean	Very useful		Useful		Not useful		Total	Mean
	N	%	N	%	N	%	N		N	%	N	%	N	%	N	
MEETINGS OF PROFESSIONAL ORGANIZATIONS																
1. Local professional organizations	14	14.3	61	62.2	23	23.5	98	1.91	30	10.8	118	42.4	130	46.8	278	1.64
2. State professional organizations	12	12.2	75	76.5	11	11.2	98	2.01	31	11.2	122	44.2	123	44.6	276	1.67
3. National professional organizations	17	17.3	67	68.4	14	14.3	98	2.03	46	16.7	102	37.1	127	46.2	275	1.71

Very useful = 3

Useful = 2

Not useful = 1

and 16.7 percent for teachers). However, the national professional organizations were rated higher by the principals than by the teachers as useful as a source of information about new practices and materials in science education.

Types of Information about Science Materials and Practices

Principals and science teachers in the sample were given a list of specific types of information about science materials and practices and asked to rate the usefulness of each. Information was classified in seven categories:

A. Information about curriculum
B. Information about instruction
C. Information about classroom management
D. Information about evaluation methodology
E. Information about policies, standards, and regulations
F. Information about budget and expenditures
G. Information about court and judicial decisions related to education

Data are presented in Tables 4.135 through 4.138. Percentages of each group are presented with regard to the total number of principals or teachers responding to each item. Response options were: (1) not useful, (2) useful and (3) very useful.

Each type of information rated by more than 20 percent of the principals or the teachers as a very useful type of information is presented individually. Other types of information are presented in Tables 4.135 through 4.138.

A. Information about Curriculum

Data on Table 4.135 show that 24.4 percent of the principals responding, rated information about curriculum as a very useful type of information compared with 21.3 percent of the teachers. Data also reveal that approximately 72 percent of the principals and 64.9 percent of the teachers responding, considered information about curriculum a useful type of information. The mean of the principals' responses (2.21) was higher than the mean of the teachers (2.06).

National Science Foundation (NSF) sponsored materials

The percentage of the principals rating NSF sponsored materials as a very useful type of information about science curriculum was quite similar to that of the teachers (29.3 percent for principals and 29.2 for teachers). However, higher percentage of the principals (61.6 percent) considered NSF sponsored materials useful type information about curriculum compared with 49.8 percent of the teachers (Table 4.135, p. 317). The mean of the principals' responses (2.20) was higher than the mean of the teachers (2.08).

State curriculum guides and materials

While approximately 22 percent of the principals considered state curriculum guides and materials to be a very useful type of information, no more than 4.8 percent of the teachers considered state curriculum guides and materials very useful as a type of information about curriculum. Also, approximately 64 percent of the principals rated state curriculum guides and materials as a useful type of curriculum compared with 48 percent of the teachers (Table 4.135). The mean of the principals' responses (2.07) was higher than the mean of the teacher (1.58).

Locally developed curriculum materials

Locally developed curriculum materials were considered a very

TABLE 4.135

FREQUENCY DISTRIBUTION OF THE RESPONSES OF THE PRINCIPALS AND THE TEACHERS REGARDING THE UTILITY OF INFORMATION ABOUT CURRICULUM BY PRINCIPAL/TEACHER

Types of information	Principals								Teachers							
	Very useful		Useful		Not useful		Total	Mean	Very useful		Useful		Not useful		Total	Mean
	N	%	N	%	N	%	N		N	%	N	%	N	%	N	
A. Information About Curriculum	19	24.4	56	71.8	3	3.8	78	2.21	43	21.3	131	64.9	28	13.9	202	2.06
1. National Science Foundation (NSF) sponsored materials	29	29.3	61	61.6	9	9.1	99	2.20	81	29.2	138	49.8	58	20.9	277	2.08
2. State curriculum guides and materials	21	21.6	62	63.9	14	14.4	97	2.07	13	4.8	131	48.0	129	47.3	273	1.58
3. Locally developed curriculum materials	44	46.3	46	48.4	5	5.3	95	2.41	76	27.2	137	49.1	66	23.7	279	2.04
4. Implementation strategies	16	16.3	69	70.4	13	13.3	98	2.03	14	5.1	140	50.7	122	44.2	276	1.61
5. Supplementary activities	13	13.4	75	77.3	9	9.3	97	2.04	27	9.7	164	59.0	87	31.3	278	1.78
6. Philosophy/rationale underlying curriculum	10	10.3	68	70.1	19	19.6	97	1.91	16	5.8	112	40.6	148	53.6	276	1.52

Very useful = 3 useful = 2 Not useful = 1

useful type of information about curriculum by a higher percentage of principals than teachers (46.3 percent for principals and 27.2 percent for teachers). However, the percentage of the principals rating locally developed curriculum materials a useful type of information about curriculum appears to be quite similar to that of the teachers (48.4 percent for principals and 49.1 percent for teachers). The mean of the principals' responses (2.41) was higher than the mean of the teachers (2.04).

Summary

The highest rating for principals was for information of locally developed curriculum materials. Principals rated most of the other types of information about the same (useful). Teachers rated information about NSF sponsored materials and local materials about equal (useful). They rated other items lower.

B. Information about Instruction

As shown in Table 4.136, p. 320, information about instruction was considered a very useful type of information by 30.1 percent of the principals, and 24.5 percent of the teachers responding. Also, approximately 66 percent of the principals rated information about instruction as a useful type of information compared with 58.5 percent of the teachers. The mean of the principals' responses (2.26) was higher than the mean of the teachers (2.07).

Teaching techniques

The percentage of the principals rating teaching techniques as a very useful type of information about science instruction was almost similar to that of the teachers (31.3 percent for principals and 30.4

percent for teachers). However, a higher percent of the principals than the teachers considered teaching techniques useful type of information (66.7 percent for principals and 58 percent of teachers). The mean of the principals' responses (2.29) was higher than the mean of the teachers (2.19).

Laboratory techniques

While 44.4 percent of the teachers responding considered laboratory techniques to be very useful type of information, about 27 percent of the principals rated laboratory techniques very useful as a type of information. Also, 66.3 percent of the principals considered laboratory techniques a useful type of information compared with 45.5 percent of the teachers. The mean of the teachers' responses (2.34) was higher than the mean of the principals (2.19). (Table 4.136).

Individualized instruction

Data on Table 4.136 show that 26.5 percent of the principals and 18.9 percent of the teachers rated individualized instruction as a very useful type of information. Individualized instruction was also considered a useful type of information by 62.2 percent of the principals and 55.6 percent of the teachers. The mean of the principals' responses (1.76) was higher than the mean of the teachers (1.59).

Summary

The highest rating for principals was for information of teaching techniques. Principals rated most of the other types of information about instruction about the same (useful). Teachers rated information about laboratory techniques the highest. They rated other items lower.

C. Information about Classroom Management

TABLE 4.136

FREQUENCY DISTRIBUTION OF THE RESPONSES OF THE PRINCIPALS AND THE TEACHERS REGARDING THE UTILITY OF INFORMATION ABOUT INSTRUCTION BY PRINCIPAL/TEACHER

Types of information	Principals								Teachers							
	Very useful		Useful		Not useful		Total	Mean	Very useful		Useful		Not useful		Total	Mean
	N	%	N	%	N	%	N		N	%	N	%	N	%	N	
B. Information About Instruction	22	30.1	48	65.8	3	4.1	73	2.26	49	24.5	117	58.5	34	17.0	200	2.07
1. Teaching techniques	31	31.3	66	66.7	2	2.0	99	2.29	84	30.4	160	58.0	32	11.6	276	2.19
2. Laboratory techniques	26	26.5	65	66.3	7	7.1	98	2.19	124	44.4	127	45.5	28	10.0	279	2.34
3. Individualized instruction	26	26.5	61	62.2	11	11.2	98	2.15	52	18.9	153	55.6	70	25.5	275	1.94
4. Televised instruction	8	8.2	58	58.9	31	32.0	97	1.76	18	6.6	123	45.4	130	48.0	271	1.59
5. Audiovisual instruction	17	17.3	68	69.4	13	13.3	98	2.04	43	15.8	157	57.7	72	26.5	272	1.89

Very useful = 3 useful = 2 Not useful = 1

Data on Table 4.137 show that information about classroom management was considered a very useful type of information by 27.4 percent of the principals and 16.4 percent of the teachers responding to this item. Also, 67.1 percent of the principals and 55.2 percent of the teachers rated this type of information useful. Principals rated information on this topic more useful (mean 2.22) than did teachers (mean 1.88).

Students' behavior

The percentage of the principals rating students' behavior as a very useful type of information was higher than that of the teachers (36.4 percent for principals, 20.7 percent for teachers). Approximately 57 percent of the principals considered this type of information useful compared with 51.1 percent of the teachers. Principals rated information on students' behavior more useful (mean 2.29) than did the teachers (mean 1.92). (Table 4.137).

Classroom management

While approximately 37 percent of the principals considered classroom management to be very useful type of information, 16.5 percent of the teachers rated classroom management very useful as a type of information. About 56 percent of the principals and 52 percent of the teachers rated this type of information useful. Principals rated information about classroom management more useful (mean 2.30) than did teachers (mean 1.85).

D. Information about Evaluation Methodology

Data on Table 4.138 show that 26.3 percent of the principals and 10.9 percent of the teachers responding, rated the information about

TABLE 4.137

FREQUENCY DISTRIBUTION OF THE RESPONSES OF THE PRINCIPALS AND THE TEACHERS REGARDING THE UTILITY OF INFORMATION ABOUT CLASSROOM MANAGEMENT BY PRINCIPAL/TEACHER

Types of information	Principals								Teachers							
	Very useful		Useful		Not useful		Total	Mean	Very useful		Useful		Not useful		Total	Mean
	N	%	N	%	N	%	N		N	%	N	%	N	%	N	
C. Information About Classroom Management	20	27.4	49	67.1	4	5.5	73	2.22	33	16.4	111	55.2	57	28.4	201	1.88
1. Student's behavior	36	36.4	56	56.6	7	7.1	99	2.29	57	20.7	141	51.1	78	28.3	276	1.92
2. Classroom Management	36	36.7	55	56.1	7	7.1	98	2.30	46	16.5	145	52.2	87	31.3	278	1.85

TABLE 4.138

FREQUENCY DISTRIBUTION OF THE RESPONSES OF THE PRINCIPALS AND THE TEACHERS REGARDING THE UTILITY OF SPECIFIC TYPES OF INFORMATION ABOUT SCIENCE AND PRACTICES BY PRINCIPAL/TEACHER

Types of information	Principals								Teachers							
	Very useful		Useful		Not useful		Total	Mean	Very useful		Useful		Not useful		Total	Mean
	N	%	N	%	N	%	N		N	%	N	%	N	%	N	
D. Information About Evaluation Methodology	26	26.3	61	61.6	12	12.1	99	2.14	30	10.9	141	51.3	104	37.8	275	1.73
E. Information About Policies, Standards, And Regulations	16	16.2	71	71.7	12	12.1	99	2.04	22	7.9	153	55.0	103	37.1	278	1.71
F. Information About Budget And Expenditures	25	25.3	59	59.6	15	15.2	99	2.10	38	13.7	143	51.4	97	34.9	278	1.79
G. Information About Court And Judicial Decisions Related To Education	25	25.3	58	58.6	16	16.2	99	2.09	30	10.9	147	53.6	97	35.4	274	1.75

Very useful = 3 useful = 2 Not useful = 1

evaluation methodology as a very useful type of information. On the other hand approximately 62 percent of the principals considered information about evaluation methodology useful as a type of information compared with 51.3 percent of the teachers. The mean of the principals' responses (2.14) was higher than the mean of the teachers (1.73).

F. Information about Budget and Expenditures

While 25.3 percent of the principals considered information about budget and expenditures to be very useful type of information, 13.7 percent of the teachers perceived information about budget and expenditures very useful as a type of information. Approximately 60 percent of the principals rated information about budget and expenditures a useful type of information compared with 51.4 percent of the teachers (Table 4.138). The mean of the principals' responses (2.04) was higher than the mean of the teachers (1.71).

G. Information about Court and Judicial Decisions Related to Education

A relatively low percentage of the teachers (10.9 percent) and 25.3 percent of the principals responding considered this type of information very useful. On the other hand, approximately 59 percent of the principals and 53.6 percent of the teachers rated the information about court and judicial decisions related to education as a useful type of information. The mean of the principals' responses (2.09) was higher than the mean of the teachers (1.75).

Summary

Principals valued all types of information (from A to G), consistently but one, more than did teachers. Information about laboratory techniques was the only type of information which was rated higher by teachers than by principals.

How Soon Information about Science Materials and Practices is Needed

Principals and science teachers in the sample were given a list of specific types of information about science materials and practices and asked to specify how soon usually they needed these types of information. Response options were: (1) within six months, (2) within one month, (3) within a week, and (4) within 48 hours. Data are presented in Tables 4.139 through 4.142.

A. Information about Curriculum

Data for this information are presented on Table 4.139. Means for the principals' responses ranged from 1.87 to 2.46. Means for the teachers were about the same, from 1.74 to 2.48. Information was generally needed in about one month. Information about locally developed curriculum materials was desired most rapidly.

B. Information about Instruction

Data for this information are presented on Table 4.140. Means of the principals' responses ranged from 1.95 to 2.17. Means for the teachers were about the same, from 2.00 to 2.17. Information was generally needed in about one month. Information about teaching techniques was desired most rapidly by principals, while information about televised instruction and audiovisual instruction was desired most rapidly by teachers.

C. Information about Classroom Management

Data for this information are presented on Table 4.141. Means of the principals' responses ranged from 2.15 to 2.19. Means for the teachers were about the same, from 2.01 to 2.20. Information was generally needed in about one month. Information about students' behavior was desired most rapidly.

D. Information about Evaluation Methodology

Data for this information are presented on Table 4.142. The mean of the principals' responses (1.91) was higher than the mean of the teachers (1.84). Information was generally needed in about one month. Information about evaluation methodology was desired more rapidly by principals than by teachers.

E. Information about Policies, Standards and Regulations

Data for this information are presented on Table 4.142. The mean of the principals' responses (2.09) was higher than the mean of the teachers (1.97). Information was generally needed in about one month. Information about policies, standards and regulations was desired more rapidly by principals than by teachers.

F. Information about Budget and Expenditures

Data for this information are presented on Table 4.142. The mean of the principals' responses (2.19) was higher than the mean of the teachers (2.03). Information was generally needed in about one month. Information about budget and expenditures was desired more rapidly by principals than by teachers.

G. Information about Court and Judicial Decisions Related to Education

Data for this information are presented on Table 4.142. The mean of the principals' responses (2.04) was higher than the mean of the teachers

TABLE 4.139

FREQUENCY DISTRIBUTION OF THE RESPONSES OF THE PRINCIPALS AND THE TEACHERS RATINGS OF THE TIME NEEDED FOR REQUESTING INFORMATION ABOUT CURRICULUM BY PRINCIPAL/TEACHER

Types of information	Principals										Teachers									
	Within 48 hours		Within a week		Within one month		Within 6 months		Total	Mean	Within 48 hours		Within a week		Within one month		Within 6 months		Total	Mean
	N	%	N	%	N	%	N	%	N		N	%	N	%	N	%	N	%	N	
A. Information About Curriculum	1	1.4	9	12.5	46	63.9	16	22.2	72	1.93	2	1.1	25	13.7	120	65.9	35	19.2	182	1.97
1. NSF programs*	1	1.1	9	9.6	62	66.0	22	23.4	94	1.88	1	0.4	33	14.0	153	64.8	49	20.8	236	1.94
2. State curriculum guides and materials	0	0.0	20	21.5	52	55.9	21	22.6	93	1.99	5	2.2	40	17.2	123	53.0	64	27.6	232	1.94
3. Locally developed curriculum materials	11	11.7	32	34.0	40	42.6	11	11.7	94	2.46	33	13.7	84	34.9	89	36.9	35	14.5	241	2.48
4. Implementation strategies	3	3.2	17	17.9	56	58.9	19	20.0	95	2.04	2	0.9	45	19.1	135	57.4	53	22.6	235	1.98
5. Supplementary activities	0	0.0	18	18.8	61	63.5	17	17.7	96	2.01	9	3.8	55	23.5	121	51.7	49	20.9	234	2.10
6 Philosophy/ rationale underlying curriculum	3	3.1	10	10.4	54	56.3	29	30.2	96	1.87	5	2.2	21	9.1	113	49.1	91	39.6	230	1.74

*National Science Foundation (NSF) sponsored materials

TABLE 4.140

FREQUENCY DISTRIBUTION OF THE RESPONSES OF THE PRINCIPALS AND THE TEACHERS RATINGS OF THE TIME NEEDED FOR REQUESTING INFORMATION ABOUT INSTRUCTION BY PRINCIPAL/TEACHER

Types of information	Principals										Teachers									
	Within 48 hours		Within a week		Within one month		Within 6 months		Total	Mean	Within 48 hours		Within a week		Within one month		Within 6 months		Total	Mean
	N	%	N	%	N	%	N	%	N		N	%	N	%	N	%	N	%	N	
B. Information About Instruction	3	4.6	13	20.0	37	56.9	12	18.5	65	2.11	7	4.0	34	19.3	98	55.7	37	21.0	176	2.06
1. Teaching techniques	6	6.5	20	21.5	51	54.8	16	17.2	93	2.17	10	4.1	42	17.4	136	56.4	53	22.0	241	2.04
2. Laboratory techniques	5	5.4	19	20.4	54	58.1	15	16.1	93	2.15	11	4.5	58	24.0	130	53.7	43	17.8	242	2.15
3. Individualized instruction	5	5.5	16	17.6	50	54.9	20	22.0	91	2.07	8	3.4	42	17.9	128	54.5	57	24.3	235	2.00
4. Televised instruction	3	3.3	15	16.5	47	51.6	26	28.6	91	1.95	19	8.2	56	24.1	102	44.0	55	23.7	232	2.17
5. Audiovisual instruction	3	3.3	15	16.7	50	55.6	22	24.4	90	1.99	19	8.1	60	25.5	97	41.3	59	25.1	235	2.17

TABLE 4.141

FREQUENCY DISTRIBUTION OF THE RESPONSES OF THE PRINCIPALS AND THE TEACHERS RATINGS OF THE TIME NEEDED FOR REQUESTING INFORMATION ABOUT CLASSROOM MANAGEMENT BY PRINCIPAL/TEACHER

Types of information	Principals										Teachers									
	Within 48 hours		Within a week		Within one month		Within 6 months		Total	Mean	Within 48 hours		Within a week		Within one month		Within 6 months		Total	Mean
	N	%	N	%	N	%	N	%	N		N	%	N	%	N	%	N	%	N	
C. Information About Classroom Management	6	8.8	10	14.7	39	57.4	13	19.1	68	2.13	14	7.8	28	15.6	84	46.7	54	30.0	180	2.01
1. Students' behavior	9	9.7	18	19.4	48	51.6	18	19.4	93	2.19	30	12.8	47	20.1	96	41.0	61	26.1	234	2.20
2. Classroom management	9	9.7	17	18.3	49	52.7	18	19.4	93	2.18	20	8.7	43	18.7	100	43.5	67	29.1	230	2.07

TABLE 4.142

FREQUENCY DISTRIBUTION OF THE RESPONSES OF THE PRINCIPALS AND THE TEACHERS RATINGS OF THE TIME NEEDED FOR REQUESTING INFORMATION ABOUT SPECIFIC AREAS BY PRINCIPAL/TEACHER

Types of information	Principals										Teachers									
	Within 48 hours		Within a week		Within one month		Within 6 months		Total	Mean	Within 48 hours		Within a week		Within one month		Within 6 months		Total	Mean
	N	%	N	%	N	%	N	%	N		N	%	N	%	N	%	N	%	N	
D. Information About Evaluation Methodology	1	1.1	14	15.6	51	56.7	24	26.7	90	1.91	4	1.7	37	16.1	106	46.1	83	36.1	230	1.84
E. Information About Policies, Standards, And Regulations	5	5.4	18	19.4	50	53.8	20	21.5	93	2.09	17	7.2	43	18.3	92	39.1	83	35.3	235	1.97
F. Information About Budget And Expenditures	11	11.8	15	16.1	48	51.6	19	20.4	93	2.19	11	4.6	52	21.9	106	44.7	68	28.7	237	2.03
G. Information About Court And Judicial Decisions Related To Education	5	5.5	12	13.2	56	61.5	18	19.8	91	2.04	11	4.7	35	14.8	102	43.2	88	37.3	236	1.87

(1.87). Information about court and judicial decisions related to education was desired more rapidly by principals than teachers.

Federal Support for Curriculum Development

Principals and teachers were asked to indicate their agreement or disagreement with each of specific statements about federal support for curriculum development. Response options were: (1) strongly disagree, (2) disagree, (3) neutral, (4) agree and (5) strongly agree. Results are shown in Table 4.143. Percentages of each group are presented with regard to the total number of the principals or the teachers responding to each item.

Principal means ranged from 2.69 to 3.88. They agreed (3.5 to 3.88) with statements a,c,f,g, and h. They were on the positive side of neutral on statement b, neutral on statement e, and on the disagree side of neutral on item d.

Teacher means ranged from 2.54 to 4.02. They agreed (3.5 to 4.02) with statements a,c,f,g, and h as did the principals. They were on the positive side of neutral on statement b, neutral on statement e, and on the disagree side of neutral on item d as were the principals.

The responses of the principals and teachers were essentially the same.

A. Federal Support for Course Improvement and Dissemination has Improved the Quality of Curriculum Alternatives Available to Schools

An examination of Table 4.143 shows that of the principals responding 13.1 percent strongly agreed, and 55.6 percent agreed that the federal support for course improvement and dissemination has improved the quality of curriculum alternatives to schools, while approximately 19 percent of the teachers strongly agreed and 39.2 percent agreed with the statement. Results also show that 29.7 percent of the teachers were neutral compared with 20.2 of the principals.

B. The Federal Course Improvement Effort has Improved the Quality of Classroom Instruction

Data on Table 4.143 reveal that of the principals responding, only 7.1 percent strongly agreed and 43.4 percent agreed that the federal course improvement effort has improved the quality of classroom instruction, compared with 14.2 percent of the teachers who strongly agreed and 32.4 who agreed with the statement. Results also show that almost the same percent of the principals and the teachers strongly disagreed with this statement (3 percent for principals and 4 percent for teachers).

C. The Federal Government Should Direct more Attention toward Disseminating Materials and Practices

Data on Table 4.143 show that the percent of responses of the principals and the teachers for the five options were almost similar. Approximately 15 percent of each group strongly agreed, and approximately 5 percent strongly disagreed. About 43 percent of the principals agreed that the federal government should direct more attention toward disseminating materials and practices, compared with 38.2 percent of the teachers.

D. Federal Support of the Development of Materials and Practices Is Probably Unnecessary

TABLE 4.143

FREQUENCY DISTRIBUTION OF THE RESPONSES OF THE PRINCIPALS AND THE TEACHERS REGARDING THE FEDERAL SUPPORT FOR CURRICULUM DEVELOPMENT BY PRINCIPAL/TEACHER

	Principals											
	Strongly agree		Agree		Neutral		Disagree		Strongly disagree		Total	Mean
Statement	N	%	N	%	N	%	N	%	N	%	N	
A. Federal support for course improvement and dissemination has improved the quality of curriculum alternatives available to schools	13	13.1	55	55.6	20	20.2	9	9.1	2	2.0	99	3.69
B. The federal course improvement effort has improved the quality of classroom instruction	7	7.1	43	43.4	28	28.3	18	18.2	3	3.0	99	3.33
C. The federal government should direct more attention toward disseminating materials and practices	15	15.2	43	43.4	24	24.2	12	12.1	5	5.1	99	3.51
D. Federal support of the development of materials and practices is probably unnecessary	4	4.1	25	25.5	17	17.3	41	41.8	11	11.2	98	2.69
E. Federal support for course improvement and dissemination tends to create a nationally uniform curriculum	8	8.1	37	37.4	20	20.2	32	32.3	2	2.0	99	3.17
F. The National Science Foundation (NSF) should sponsor programs to help teachers learn to implement NSF-funded courses and materials	15	15.2	63	63.6	16	16.2	4	4.0	1	1.0	99	3.88
G. The National Science Foundation (NSF) should sponsor programs to help teachers learn to implement non-NSF funded courses and materials	13	13.1	59	59.6	19	19.2	7	7.1	1	1.0	99	3.77
H. Federal funding should be provided to schools for the purchase of lab equipment and facilities	24	24.5	38	38.8	15	15.3	15	15.3	6	6.1	98	3.60

TABLE 4.143 CONTINUED

Statement	Teachers											
	Strongly agree		Agree		Neutral		Disagree		Strongly disagree		Total	Mean
	N	%	N	%	N	%	N	%	N	%	N	
A. Federal support for course improvement and dissemination has improved the quality of curriculum alternatives available to schools	51	18.7	107	39.2	81	29.7	24	8.8	10	3.7	273	3.60
B. The federal course improvement effort has improved the quality of classroom instruction	39	14.2	89	32.4	98	35.6	38	13.8	11	4.0	275	3.39
C. The federal government should direct more attention toward disseminating materials and practices	42	15.3	105	38.2	83	30.2	32	11.6	13	4.7	275	3.48
D. Federal support of the development of materials and practices is probably unnecessary	16	5.8	36	13.1	71	25.9	109	39.8	42	15.3	274	2.54
E. Federal support for course improvement and dissemination tends to create a nationally uniform curriculum	16	5.9	84	30.8	68	24.9	90	33.0	15	5.5	273	2.99
F. The National Science Foundation (NSF) should sponsor programs to help teachers learn to implement NSF-funded courses and materials	80	29.0	141	51.1	43	15.6	7	2.5	5	1.8	276	4.02
G. The National Science Foundation (NSF) should sponsor programs to help teachers learn to implement non-NSF funded courses and materials	58	21.1	128	46.5	69	25.1	15	5.5	5	1.8	275	3.80
H. Federal funding should be provided to schools for the purchase of lab equipment and facilities	97	35.0	96	34.7	45	16.2	23	8.3	16	5.8	277	3.85

Low percentages of the principals and the teachers strongly agreed (4.1 percent for principals and 5.8 for teachers) or agreed (25.5 percent for the principals and 13.1 percent for teachers) that the federal support of the development of materials and practices is probably unnecessary.

E. Federal Support for Course Improvement and Dissemination Tends to Create a Nationally Uniform Curriculum

Table 4.143 shows that of the principals responding to this statement, only 8.1 percent strongly agree that the federal support for course improvement and dissemination tends to create a nationally uniform curriculum compared with 5.9 percent of the teachers. On the other hand, 37.4 percent of the principals agreed with the statement compared with 30.8 percent of the teachers.

F. The National Science Foundation (NSF) Should Sponsor Programs to Help Teachers Learn to Implement NSF-funded Courses and Materials

As shown in Table 4.143, a high percentage of the teachers (29 percent) compared with 15.2 of the principals strongly agreed that the NSF should sponsor programs to help teachers learn to implement NSF-funded courses and materials. Also, approximately 64 percent of the principals and 51.1 percent of the teachers agreed with this statement.

G. The National Science Foundation (NSF) Should Sponsor Programs to Help Teachers Learn to Implement Non-NSF funded Courses and Materials

Data on Table 4.143 reveal that a high percent of the principals and the teachers (13.1 percent strongly agree, 59.6 percent agree for the principals and 21.1 percent strongly agree, 46.5 agree for the teachers) believed that the NSF should sponsor programs to help teachers learn to implement non-NSF funded courses and materials.

H. Federal Funding Should be Provided to Schools for the Purchase of Lab Equipment and Facilities

As shown on Table 4.143, of the principals responding 24.5 percent strongly agreed and 38.8 percent agreed that federal funding should be provided to schools for the purchase of lab equipment and facilities. On the other hand, of the teachers responding 35 percent strongly agreed and 34.7 percent agreed with the statement.

Effect of the Reduction of the NSF Funds for Science Education

Principals and teachers were asked to indicate whether they knew or did not know that the NSF had recently reduced the funds for science education. They were also asked to rate their attitude toward the effect the recent reduction of the NSF funds for science education has had on science curricula.

Data on Table 4.144 show that the majority of the principals (90.6 percent) and the teachers (86.8 percent) did know that the NSF funds for science education had been reduced.

Table 4.145 reveals that 13.8 percent of the principals responding, felt that the reduction of the NSF had a very negative effect on science curricula compared with 19.9 percent of the teachers. Also, 33.3 percent of the principals and 48.3 percent of the teachers indicated that the reduction of the NSF funds had a negative impact on science curricula. A small percent of the principals and the teachers perceived that the reduction of NSF funds had a positive or very positive effect on science curricula.

TABLE 4.144

FREQUENCY DISTRIBUTION OF THE RESPONSES OF THE PRINCIPALS AND THE TEACHERS REGARDING THEIR KNOWLEDGE OF THE REDUCTION OF NSF FUNDS FOR SCIENCE EDUCATION BY PRINCIPAL/TEACHER

Knowledge	Number of principals	Percent of principals	Number of teachers	Percent of teachers
Don't know	9	9.4	36	13.2
Know	87	90.6	236	86.8
Total	96	100.0	272	100.0

The principal mean was 2.41 and the teacher mean 2.18. These results indicate they perceived the reduction in NSF funds had a negative effect on science education. (See Table4.145).

TABLE 4.145

FREQUENCY DISTRIBUTION OF THE RESPONSES OF THE PRINCIPALS AND THE TEACHERS REGARDING THE EFFECT OF THE REDUCTION OF THE NSF FUNDS FOR SCIENCE EDUCATION BY PRINCIPAL/TEACHER

Principals												Teachers											
Very Positive		Positive		Neutral		Negative		Very Negative		Total	Mean	Very Positive		Positive		Neutral		Negative		Very Negative		Total	Mean
N	%	N	%	N	%	N	%	N	%	N		N	%	N	%	N	%	N	%	N	%	N	
0	0.0	2	2.3	44	50.6	29	33.3	12	13.8	87	2.41	3	1.3	9	3.8	63	26.7	114	48.3	47	19.9	236	2.18

Components Of The Secondary School Science Education

Principals and teachers were given a list of specific science education components and asked to rate the importance of each one. Response options were: (1) not important, (2) important, and (3) very important. Data are presented in Table 4.146. Percentages of each group are presented with regard to the total number of principals or teachers responding to each item. Means for the principals ranged from 2.37 to 2.68 and for the teachers from 2.30 to 2.69. All components were ranked between important and very important. The science education components included are:

Factual Knowledge: Facts, Concepts, Principles

Factual knowledge was considered very important by 57.1 percent of the principals compared with 67.7 percent of the teachers. Also, approximately 42 percent of the principals and 31.9 percent of the teachers perceived factual knowledge as an important component of secondary school science education. The mean for the principals was 2.56; the mean for the teachers was 2.67.

Processes of Science

Processes of science were rated quite similarly by the principals and the teachers. Approximately 70 percent of the principals and the teachers considered the processes very important as a component of science education. Also, about 28 percent of the principals and the teachers perceived the processes as an important component of science education for secondary schools. The mean for the principals was 2.68; the mean for the teachers was 2.69.

Interaction of Science and Society

A majority of the principals (60.2 percent) and the teachers (55.2 percent) responding considered the interaction of science and society as a very important component of the secondary school science program. Also, approximately 37 percent of the principals and 43 percent of the teachers perceived the interaction of science and society important as a component of science program. The mean for the principals was 2.57; the mean for the teachers was 2.53.

Interaction of Science and Technology

Interaction of science and technology was considered by about 66 percent of the principals as a very important science education component compared with about 57 percent of the teachers. Approximately 34 percent of the principals rated it important compared with 42.7 percent of the teachers. The mean for the principals was 2.66; the mean for the teachers was 2.59.

Values and Ethics of Science

Approximately 44 percent of the principals and 40 percent of the teachers rated the values and ethics of science as very important component. About 50 percent of the principals and 55 percent of the teachers perceived the values and ethics of science important as a component of secondary school science education. The mean for the principals was 2.38; the mean for the teachers was 2.35.

Appreciation of Human and Scientific Endeavor

Appreciation of human and scientific endeavor was rated by over 40 percent of the principals and the teachers as very important. Also, 54.1 percent of the principals and 51.4 percent of the teachers considered it important as a science education component. The mean for the principals was 2.38; the mean for the teachers was 2.39.

Attitudes toward Science

About 61 percent of the teachers considered attitudes toward science as a very important component for science education compared with 43 percent of the principals. About 55 percent of the principals and 37 percent of the teachers rated attitudes toward science important as a science education component. The mean for the principals was 2.40; the mean for the teachers was 2.60.

Interrelationship of Science and Humanities

About 46 percent of the principals and 37 percent of the teachers rated the interrelationship of science and humanities very important. Another 51 percent of the principals and 57 percent of the teachers considered this component important. The mean for the principals was 2.43; the mean for the teachers was 2.30.

Career Knowledge and Awareness

Career knowledge and awareness was considered very important by 53.1 percent of the principals and by 46.1 percent of the teachers. Also, approximately 46 percent of the principals and 50.7 percent of the teachers considered career knowledge and awareness important. The mean for the principals was 2.52; the mean for the teachers was 2.43.

TABLE 4.146

FREQUENCY DISTRIBUTION OF THE RESPONSES OF THE PRINCIPALS AND THE TEACHERS REGARDING THE IMPORTANCE OF SPECIFIC COMPONENTS FOR THE SECONDARY SCHOOL SCIENCE EDUCATION BY PRINCIPAL/TEACHER

	Principals								Teachers							
	Very important		Important		Not important		Total	Mean	Very important		Important		Not important		Total	Mean
Science education components	N	%	N	%	N	%	N		N	%	N	%	N	%	N	
Factual knowledge: Facts, concepts, principles	56	57.1	41	41.8	1	1.0	98	2.56	191	67.7	90	31.9	1	0.4	282	2.67
Processes of science	69	70.4	27	27.6	2	2.0	98	2.68	198	70.2	81	28.7	3	1.1	282	2.69
Interaction of science and society	59	60.2	36	36.7	3	3.1	98	2.57	155	55.2	121	43.1	5	1.8	281	2.53
Interaction of science and technology	65	66.3	33	33.7	0	0.0	98	2.66	159	56.6	120	42.7	2	0.7	281	2.59
Values and ethics of science	43	43.9	49	50.0	6	6.1	98	2.38	113	40.4	153	54.6	14	5.0	280	2.35
Appreciation of human and scientific endeavor	41	41.8	53	54.1	4	4.1	98	2.38	122	43.6	144	51.4	14	5.0	280	2.39
Attitudes toward science	42	42.9	54	55.1	2	2.0	98	2.40	173	61.3	105	37.2	4	1.4	282	2.60
Interrelationship of science and humanities	45	45.9	50	51.0	3	3.1	98	2.43	103	36.8	159	56.8	18	6.4	280	2.30
Career knowledge and awareness	52	53.1	45	45.9	1	1.0	98	2.52	130	46.1	143	50.7	9	3.2	282	2.43
Skills	52	53.1	44	44.9	2	2.0	98	2.51	145	51.6	130	46.3	6	2.1	281	2.50
Nature of science	38	38.8	58	59.2	2	2.0	98	2.37	121	42.9	156	55.3	5	1.8	282	2.41
Relationships of self and environment	59	60.2	38	38.8	1	1.0	98	2.59	180	63.8	96	34.0	6	2.1	282	2.62

Very Important = 3 Important = 2 Not Important = 1

Skills

Skills were rated almost similarly by the principals and the teachers. Approximately 53 percent of the principals and 52 percent of the teachers rated skills very important. Also, 45 percent of the principals and 46 percent of the teachers checked skills as important. The mean for the principals was 2.51; the mean for the teachers was 2.50.

Nature of Science

Approximately 39 percent of the principals and 43 percent of the teachers perceived the nature of science as very important. About 59 percent of the principals and 55 percent of the teachers considered the nature of science as important. The mean for the principals was 2.37; the mean for the teachers was 2.41.

Relationships of Self and Environment

Over 60 percent of the principals and the teachers rated the relationships of self and environment as very important. Approximately 39 percent of the principals and 34 percent of the teachers considered this component important. The mean for the principals was 2.59; the mean for the teachers was 2.62.

Rank Order of the Components of Science Education

Examination of the data on Table 4.147 shows that the twelve listed components were rated by approximately 39 percent or more of the principals as very important components of science education for secondary schools. These components are ranked in order in Table 4.147. Also, approximately 37 percent or more of the teachers considered these components very important for secondary schools. The components are ranked in order in Table 4.148.

TABLE 4.147

RANK ORDER OF THE PRINCIPALS' RESPONSES REGARDING THEIR CONSIDERATION OF SPECIFIC COMPONENTS OF SCIENCE EDUCATION AS VERY IMPORTANT

Rank	Science education component	Percent
1	Processes of science	70.4
2	Interaction of science and technology	66.3
3	Relationships of self and environment	60.2
4	Interaction of science and society	60.2
5	Factual knowledge: facts, concepts, principles	57.1
6	Career knowledge and awareness	53.1
7	Skills	53.1
8	Interrelationship of science and humanities	45.9
9	Values and ethics of science	43.9
10	Attitudes toward science	42.9
11	Appreciation of human and scientific endeavor	41.8
12	Nature of science	38.8

Data on Tables 4.147 and 4.148 show similarities between the principals' and the teachers' responses. Both the principals and the teachers (about 70 percent) rated the processes of science as the most important component of science education for secondary schools. However, the teachers valued factual knowledge (facts, concepts and principles) more than did the principals. The teachers rated factual knowledge the second most important component (about 68 percent) and the principals rated factual knowledge the fifth most important component of science education for secondary schools (57 percent).

TABLE 4.148

RANK ORDER OF THE TEACHERS' RESPONSES REGARDING THEIR CONSIDERATION OF SPECIFIC COMPONENTS OF SCIENCE EDUCATION AS VERY IMPORTANT

Rank	Science education component	Percent
1	Processes of science	70.2
2	Factual knowledge: Facts, concepts, principles	67.7
3	Relationships of self and environment	63.8
4	Attitudes toward science	61.3
5	Interaction of science and technology	56.6
6	Interaction of science and society	55.2
7	Skills	51.6
8	Career knowledge and awareness	46.1
9	Appreciation of human and scientific endeavor	43.6
10	Nature of science	42.9
11	Values and ethics of science	40.4
12	Interrelationship of science and humanities	36.8

Barriers To Change

Principals and teachers in the sample were given a list of specific factors each of which may have a negative effect on the improvement of practice in science programs. These problems are considered barriers to change. Principals and teachers were asked to rate the seriousness of each one. Response options were: (3) serious problem, (2) somewhat a problem, (1) not a significant problem. Data are presented in Table 4.149, pp. 355. Percentages of each group are presented with regard to the total number of the principals or the teachers responding to each item.

Means for principals' responses ranged from 1.19 to 2.25; means for the teachers ranged from 1.36 to 2.44. Teachers perceived more items as barriers to change than did principals.

Lack of Inservice Opportunities

Lack of inservice opportunities was considered a serious problem by about 10 percent of the principals and by 13.5 percent of the teachers. About 39 percent of the principals and 43 percent of the teachers did not consider this a significant problem. The mean for the principals was 1.71; the mean for the teacher was 1.68. (Table 4.149, p 355)

Lack of Adequate Consultant Services

Lack of adequate consultant services was considered a serious problem by about 6 percent of the principals and by approximately 14 percent of the teachers. About 53 percent of the principals and 47 percent of the teachers felt that lack of adequate consultant services was not a significant problem. The mean for the principals was 1.53;

the mean for the teachers was 1.67.

Inadequate Facilities

Inadequate facilities was considered a serious problem by about 19 percent of the principals and by 30 percent of the teachers. About 51 percent of the principals and 29.4 percent of the teachers did not consider this a significant problem. The mean for the principals was 1.69; the mean for the teachers was 2.01. (Table 4.149, p. 355)

Lack of Science Equipment and Supplies

Lack of science equipment and supplies was considered a serious problem by about 15 percent of the principals and by 33 percent of the teachers. About 52 percent of the principals and 25 percent of the teachers felt that lack of science equipment and supplies was not a significant problem. The mean for the principals was 1.64; the mean for the teachers was 2.08. (Table 4.149, p. 355)

Lack of Materials for Individualized Instruction

Lack of materials for individualized instruction was considered a serious problem by about 13 percent of the principals and by approximately 30 percent of the teachers. About 54 percent of the principals and 27.4 percent of the teachers did not consider this a significant problem. The mean for the principals was 1.60; the mean for the teachers was 2.03.

Insufficient Budget

Insufficient budget was considered a serious problem by about 19 percent of the principals and by 42 percent of the teachers. About 41 percent of the principals and approximately 19 percent of the teachers did not consider this a significant problem. The mean for the principals was 1.78; the mean for the teachers was 2.36.

High Costs of Curriculum Materials

High costs of curriculum materials was considered a serious problem by 36 percent of the principals and by approximately 52 percent of the teachers. Eleven percent of the principals and 10 percent of the teachers felt that high costs of curriculum materials was not a significant problem. The mean for the principals was 2.25; the mean for the teachers was 2.42. (Table 4.149, p. 355)

Out-of-Date Teaching Materials

Out-of-date teaching materials was considered a serious problem by 13 percent of the principals and by 15 percent of the teachers. Fifty-four percent of the principals and approximately 44 percent of the teachers did not consider this a significant problem. The mean for the principals was 1.59; the mean for the teachers was 1.71.

No Agreement on what Should be Included in the Curriculum

No agreement on what should be included in the curriculum was considered a serious problem by about 10 percent of the principals and by approximately 10 percent of the teachers. Approximately 63 percent of the principals and 62 percent of the teachers did not consider this a significant problem. The mean for the principals was quite similar to the mean of the teachers (1.48).

Low Priority of Science Education

Low priority of science education was considered a serious problem by about 8 percent of the principals and by approximately 19 percent of the teachers. About 73 percent of the principals and 52 percent of the teachers felt that low priority of science education was not a significant problem. The mean for the principals was 1.35; the mean for the teachers was 1.67.

Inadequate Student Reading Ability

Inadequate student reading ability was considered a serious problem by about 30 percent of the principals and by 53 percent of the teachers. About 16 percent of the principals and approximately 9 percent of the teachers did not consider this a significant problem. The mean for the principals was 2.14; the mean for the teachers was 2.44. (Table 4.149, p. 356)

Inadequate Student Mathematics Background

Inadequate student mathematics background was considered a serious problem by about 24 percent of the principals and by 45 percent of the teachers. About 25 percent of the principals and 14 percent of the teachers felt that inadequate student mathematics background was not a significant problem. The mean for the principals was 2.00; the mean for the teachers was 2.32.

Low Enrollment in Science Courses

Low enrollment in science courses was considered a serious problem by only 5 percent of the principals and by approximately 14 percent of the teachers. Sixty seven percent of the principals and about 55 percent of the teachers did not consider this a significant problem. The mean for the principals was 1.38; the mean for the teachers was 1.59. (Table 4.149, p. 356)

Inadequate Articulation of Instruction across Classrooms within a Building

Inadequate articulation of instruction across classrooms within a building was considered a serious problem by only 6 percent of the principals and about 8 percent of the teachers. About 53 percent of the principals and 55 percent of the teachers did not consider this a significant problem. The mean for the principals was quite similar to the mean of the teachers (1.53).

Inadequate Articulation of Instruction across Classrooms across Buildings within a District

Inadequate articulation of instruction across classrooms across buildings within a district was considered a serious problem by about 12 percent of the principals and by approximately 16 percent of the teachers. About 45 percent of the principals and 42 percent of the teachers did not consider this a significant problem. The mean for the principals was 1.67; the mean for the teachers was 1.74.

Teachers inadequately Prepared to Teach Science

Teachers inadequately prepared to teach science was considered a serious problem by 11 percent of the principals and by about 8 percent of the teachers. Seventy-four percent of the principals and about 71 percent of the teachers did not consider this a significant problem. The mean for the principals was 1.37; the mean for the teachers was 1.36. (Table 4.149, p.356)

Lack of Teacher Planning Time

Lack of teacher planning time was considered a serious problem by about 8 percent of the principals and by 19 percent of the teachers.

About 73 percent of the principals and 40 percent of the teachers felt that lack of teacher planning time was not a significant problem. The mean for the principals was 1.35; the mean for the teachers was 1.79. (Table 4.149, p. 356)

Lack of Interest of Teachers

Lack of interest of teachers was considered a serious problem by only 9 percent of the principals and by about 8 percent of the teachers. Seventy percent of the principals and 60 percent of the teachers felt that lack of interest of teachers was not a significant problem. The mean for the principal was 1.39; the mean for the teachers was 1.48.

Lack of Federal Support for Curriculum Development

Lack of federal support for curriculum development was considered a serious problem by about 14 percent of the principals and by 16 percent of the teachers. About 60 percent of the principals and 42 percent of the teachers felt that lack of federal support for curriculum development was not a significant problem. The mean for the principals was 1.55; the mean for the teachers was 1.74. (Table 4.149, p. 356)

Lack of State Support for Curriculum Development

Lack of state support for curriculum development was considered a serious problem by about 13 percent of the principals and by 16 percent of the teachers. About 58 percent of the principals and 40 percent of the teachers did not consider this a serious problem. The mean for the principals was 1.56; the mean for the teachers was 1.76.

Lack of Local Support for Curriculum Development

Lack of local support for curriculum development was considered a serious problem by about 12 percent of the principals and by 18 percent of the teachers. About 62 percent of the principals and 43 percent of the teachers felt that lack of local support for curriculum development was not a significant problem. The mean for the principals was 1.51; the mean for the teachers was 1.75. (Table 4.149, p. 375)

Lack of Administrative Support for Change

Lack of administrative support for change was considered a serious problem by only 2 percent of the principals and by approximately 13 percent of the teachers. About 83 percent of the principals and 60 percent of the teachers felt that lack of administrative support for change was not a significant problem. The mean for the principals was 1.19; the mean for the teachers was 1.53.

Lack of Community Support for Change

Lack of community support for change was considered a serious problem by only 4 percent of the principals and by about 10 percent of the teachers. About 79 percent of the principals and 59 percent of the teachers did not consider this a serious problem. The mean for the principals was 1.25; the mean for the teachers was 1.51. (Table 4.149 p. 357)

Lack of Staff Support for Change

Lack of staff support for change was considered a serious problem by only 6 percent of the principals and by about 7 percent of the teachers. Seventy percent of the principals and approximately 68 percent of the teachers felt that lack of staff support for change was not a significant problem. The mean for the principals was 1.36; the mean for the teachers was 1.39.

State Regulations and Policies

State regulations and policies was considered a serious problem by only one percent of the principals and by about 5 percent of the teachers. About 74 percent of the principals and 67 percent of the teachers did not consider state regulations and policies a significant problem. The mean for the principals was 1.28; the mean for the teachers was 1.37. (Table 4.149, p. 357)

Federal Regulations and Policies

Federal regulations and policies was considered a serious problem by about 5 percent of the principals and by 6 percent of the teachers. About 74 percent of the principals and 70 percent of the teachers felt that federal regulations and policies was not a significant problem. The mean for the principals was 1.31; the mean for the teachers was 1.36.

Lack of Communication between Principals and Teachers

Lack of communication between principals and teachers was considered a serious problem by only 3 percent of the principals and about 12 percent of the teachers. About 81 percent of the principals and 62 percent of the teachers did not consider this a significant problem. The mean for the principals was 1.22; the mean for the teachers was 1.50. (Table 4.149, p. 357)

Lack of Consultants

Lack of consultants was considered a serious problem by only one percent of the principals and about 8 percent of the teachers. About 65 percent of the principals and 60 percent of the teachers felt that lack of consultants was not a significant problem. The mean for the principals was 1.36; the mean for the teachers was 1.48. (Table 4.149 p. 358)

Lack of Tangible Incentives to Faculty

Lack of tangible incentives to faculty was considered a serious problem by about 7 percent of the principals and approximately 34 percent of the teachers. Fourty-nine percent of the principals and about 30 percent of the teachers did not consider this a significant problem. The mean for the principals was 1.58; the mean for the teachers was 2.03.

Lack of Intangible Incentives to Faculty

Lack of intangible incentives to faculty was considered a serious problem by about 7 percent of the principals and 24 percent of the teachers. Approximately 59 percent of the principals and 36 percent of the teachers felt that lack of intangible incentives to faculty was not a significant problem. The mean of the principals was 1.49; the mean for the teachers was 1.88. (Table 4.149, p. 358)

Increasing Emphasis on Basic Skills and Knowledge

Increasing emphasis on basic skills and knowledge was considered a serious problem by only 4 percent of the principals and by about 10 percent of the teachers. About 67 percent of the principals and 58 percent of the teachers did not consider this a significant problem. The mean for the principals was 1.37; the mean for the teachers 1.52.

Lack of Laboratory Assistants

Lack of laboratory assistants was considered a serious problem by about 7 percent of the principals and 19 percent of the teachers. About 57 percent of the principals and 44 percent of the teachers felt that lack of laboratory assistants was not a significant problem. The mean of the principals was 1.51; the mean for the teachers was 1.75. (Table 4.149, p. 358)

Rank Order of the Factors Considered Barriers to Change

Examination of the data on Table 4.150 shows that 15 factors were rated by more than 10 percent of the principals as serious problems for change. These factors are ranked in order in Table 4.150.

Also, 23 factors were considered by more than 10 percent of the teachers as serious problems for change. These factors are ranked in order in Table 4.151.

While the teachers and principals agreed on the first four barriers, teachers considered them much more serious than did the principals. Among the other items considered serious barriers by a high number of teachers were tangible and intangible incentives for faculty; these were not considered serious by 10 percent of the principals.

TABLE 4.149

FREQUENCY DISTRIBUTION OF THE RESPONSES OF THE PRINCIPALS AND THE TEACHERS REGARDING THE CONSIDERATION OF SPECIFIC FACTORS AS BARRIERS TO CHANGE BY PRINCIPALS/TEACHERS

	Principals								Teachers							
	Serious problem		Somewhat of a problem		Not a significant problem		Total	Mean	Serious problem		Somewhat of a problem		Not a significant problem		Total	Mean
Factors	N	%	N	%	N	%	N		N	%	N	%	N	%	N	
Lack of inservice opportunities	10	10.1	50	50.5	39	39.4	99	1.71	38	13.5	116	41.1	128	45.4	282	1.68
Lack of adequate consultant services	6	6.1	40	40.8	52	53.1	98	1.53	39	13.9	109	38.8	133	47.3	281	1.67
Inadequate facilities	19	19.2	30	30.3	50	50.5	99	1.69	85	30.1	114	40.4	83	29.4	282	2.01
Lack of science equipment and supplies	15	15.2	33	33.3	51	51.5	99	1.64	93	33.0	118	41.8	71	25.2	282	2.08
Lack of materials for individualized instruction	13	13.1	33	33.3	53	53.5	99	1.60	84	29.9	120	42.7	77	27.4	281	2.03
Insufficient budget	19	19.2	39	39.4	41	41.4	99	1.78	118	42.1	110	39.3	52	18.6	280	2.36
High costs of curriculum materials	36	36.0	53	53.0	11	11.0	100	2.25	145	51.6	108	38.4	28	10.0	281	2.42
Out-of-date teaching materials	13	13.0	33	33.0	54	54.0	100	1.59	42	15.0	115	41.1	123	43.9	280	1.71
No agreement on what should be included in the curriculum	10	10.1	27	27.3	62	62.6	99	1.48	27	9.6	80	28.5	174	61.9	281	1.48

TABLE 4.149 (CONTINUED)

	Principals								Teachers							
	Serious problem		Somewhat of a problem		Not a significant problem		Total	Mean	Serious problem		Somewhat of a problem		Not a significant problem		Total	Mean
Factors	N	%	N	%	N	%	N		N	%	N	%	N	%	N	
Low priority of science education	8	8.1	19	19.2	72	72.7	99	1.35	52	18.5	84	29.9	145	51.6	281	1.67
Inadequate student reading ability	30	30.3	53	53.5	16	16.2	99	2.14	150	53.2	107	37.9	25	8.9	282	2.44
Inadequate student mathematics background	24	24.2	50	50.5	25	25.3	99	2.00	127	45.0	117	41.5	38	13.5	282	2.32
Low enrollment in science courses	5	5.0	28	28.0	67	67.0	100	1.38	39	13.9	86	30.7	155	55.4	280	1.59
Inadequate articulation of instruction across classrooms within a building	6	6.1	40	40.8	52	53.1	98	1.53	22	7.9	102	36.8	153	55.2	277	1.53
Inadequate articulation of instruction across classrooms across buildings within a district	12	12.2	42	42.9	44	44.9	98	1.67	44	15.8	117	41.9	118	42.3	279	1.74
Teachers inadequately prepared to teach science	11	11.0	15	15.0	74	74.0	100	1.37	21	7.6	59	21.2	198	71.2	278	1.36
Lack of teacher planning time	8	8.1	19	19.2	72	72.7	99	1.35	53	18.9	115	40.9	113	40.2	281	1.79
Lack of interest of teachers	9	9.0	21	21.0	70	70.0	100	1.39	22	7.8	90	32.0	169	60.1	281	1.48

TABLE 4.149 (CONTINUED)

Factors	Principals: Serious problem N	Principals: Serious problem %	Principals: Somewhat of a problem N	Principals: Somewhat of a problem %	Principals: Not a significant problem N	Principals: Not a significant problem %	Principals: Total N	Principals: Mean	Teachers: Serious problem N	Teachers: Serious problem %	Teachers: Somewhat of a problem N	Teachers: Somewhat of a problem %	Teachers: Not a significant problem N	Teachers: Not a significant problem %	Teachers: Total N	Teachers: Mean
Lack of federal support for curriculum development	14	14.1	26	26.3	59	59.6	99	1.55	44	15.9	116	41.9	117	42.2	277	1.74
Lack of state support for curriculum development	13	13.1	29	29.3	57	57.6	99	1.56	45	16.4	119	43.3	111	40.4	275	1.76
Lack of local support for curriculum development	12	12.1	26	26.3	61	61.6	99	1.51	49	17.7	109	39.4	119	43.0	277	1.75
Lack of administrative support for change	2	2.0	15	15.2	82	82.8	99	1.19	35	12.5	77	27.5	168	60.0	280	1.53
Lack of community support for change	4	4.0	17	17.2	78	78.8	99	1.25	27	9.7	87	31.3	164	59.0	278	1.51
Lack of staff support for change	6	6.0	24	24.0	70	70.0	100	1.36	18	6.5	72	25.9	188	67.6	278	1.39
State regulations and policies	1	1.0	25	25.5	72	73.5	98	1.28	13	4.7	78	28.1	187	67.3	278	1.37
Federal regulations and policies	5	5.2	20	20.6	72	74.2	97	1.31	17	6.2	66	23.9	193	69.9	276	1.36
Lack of communication between principals and teachers	3	3.0	16	16.2	80	80.8	99	1.22	33	11.8	73	26.2	173	62.0	279	1.50

TABLE 4.149(CONTINUED)

Factors	Principals								Teachers							
	Serious problem		Somewhat of a problem		Not a significant problem		Total	Mean	Serious problem		Somewhat of a problem		Not a significant problem		Total	Mean
	N	%	N	%	N	%	N		N	%	N	%	N	%	N	
Lack of consultants	1	1.0	34	34.3	64	64.6	99	1.36	22	7.9	90	32.4	166	59.7	278	1.48
Lack of tangible incentives to faculty	7	7.1	43	43.9	48	49.0	98	1.58	94	33.5	102	36.3	85	30.2	281	2.03
Lack of intangible incentives to faculty	7	7.2	33	34.0	57	58.8	97	1.49	68	24.4	110	39.4	101	36.2	279	1.88
Increasing emphasis on basic skills and knowledge	4	4.0	29	29.3	66	66.7	99	1.37	29	10.4	88	31.4	163	58.2	280	1.52
Lack of laboratory assistants	7	7.1	36	36.4	56	56.6	99	1.51	53	18.9	104	37.1	123	43.9	280	1.75

Serious problem = 3

Somewhat of a problem = 2

Not a significant problem = 1

TABLE 4.150

RANK ORDER OF THE PRINCIPALS' RESPONSES REGARDING THEIR CONSIDERATION OF SPECIFIC FACTORS AS SERIOUS PROBLEMS FOR CHANGE BY PRINCIPAL

Rank order	Factors	Percent
1	High costs of curriculum materials	36.0
2	Inadequate student reading ability	30.3
3	Inadequate student mathematics background	24.2
4	Insufficient budget	19.2
5	Inadequate facilities	19.2
6	Lack of science equipment and supplies	15.2
7	Lack of federal support for curriculum development	14.1
8	Lack of materials for individualized instruction	13.1
9	Lack of state support for curriculum development	13.1
10	Out-of-date teaching materials	13.0
11	Inadequate articulation of instruction across buildings within a district	12.2
12	Lack of local support for curriculum development	12.1
13	Teachers inadequately prepared to teach science	11.0
14	Lack of inservice opportunities	10.1
15	No agreement on what should be included in the curriculum	10.1

TABLE 4.131

RANK ORDER OF THE TEACHERS' RESPONSES REGARDING THEIR CONSIDERATION OF SPECIFIC FACTORS AS SERIOUS PROBLEMS FOR CHANGE BY TEACHER

Rank order	Factors	Percent
1	Inadequate student reading ability	53.2
2	High costs of curriculum materials	51.6
3	Inadequate student mathematics background	45.0
4	Insufficient budget	42.1
5	Lack of tangible incentives to faculty	33.5
6	Lack of science equipment and supplies	33.0
7	Inadequate facilities	30.1
8	Lack of materials for individualized instruction	29.9
9	Lack of intangible incentives to faculty	24.4
10	Lack of teacher planning time	18.9
11	Lack of laboratory assistants	18.9
12	Low priority of science education	18.5
13	Lack of local support for curriculum development	17.7
14	Lack of state support for curriculum development	16.4
15	Lack of federal support for curriculum development	15.9
16	Inadequate articulation of instruction across classrooms across buildings within a district	15.8
17	Out-of-date teaching materials	15.0
18	Lack of adequate consultant services	13.9
19	Low enrollment in science courses	13.9
20	Lack of inservice opportunities	13.5
21	Lack of administrative support for change	12.5
22	Lack of communication between principals and teachers	11.8
23	Increasing emphasis on basic skills and knowledge	10.4

Principals and teachers in the sample were given a list of specific tangible and intangible incentives which may encourage principals or teachers to try new ideas for the improvement of practice. Principals and teachers were asked to rate the three most important incentives (tangible or intangible). Response options were: (3) the most important, (2) the second most important and (1) the third most important.

Data are presented in Tables 4.152 and 4.153. Percentages of each group are presented with regard to the total number of the principals or the teachers responding to each item. Incentives are classified into tangible and intangible incentives.

Tangible Incentives

The seven tangible incentives listed on Table 4.152 were the following:

Extra Pay for Special Activities

Extra pay for special services as a tangible incentive was rated almost similarly by the principals and the teachers. Over 26 percent of the principals and the teachers ranked this incentive most important. Also. 19.2 percent of the principals and 18.1 percent of the teachers rated this item second most important.

Salary Differential

Salary differential was considered more important for the teachers than for the principals. Approximately 25 percent of the teachers ranked this most important compared with 12.1 percent of the principals.

Also, approximately 19 percent of the teachers considered salary differential next most important compared with 18.2 percent of the principals.

College Credit

A small percent of the principals (4.0 percent) and the teachers (9.6 percent) considered college credit most important as a tangible incentive. On the other hand about 9 percent of the principals and 10 percent of the teachers rated this item second most important.

Released Time

Released time was ranked most important by 15.2 percent of the principals compared with 13.5 percent of the teachers. On the other hand, this incentive was rated quite similarly (approximately 24 percent) by both the principals and the teachers as second most important.

Travel Funds

Data on Table 4.152 show that a small number of the principals and teachers (7.1 percent for the principals and 6.0 percent for the teachers) considered travel funds most important. Also, 14.1 percent of the principals ranked it second most important compared with 10.7 percent of the teachers.

Participating in Workshops and In-service Training Courses

Participating in workshops and inservice training courses was ranked most important by 27.3 percent of the principals and 12.5 percent of the teachers. On the other hand 7.1 percent of the principals considered this incentive second most important compared with 15.3 percent of the teachers.

TABLE 4.152

FREQUENCY DISTRIBUTION OF THE RESPONSES OF THE PRINCIPALS AND THE TEACHERS REGARDING THE IMPORTANCE OF SPECIFIC TANGIBLE INCENTIVES BY PRINCIPALS/TEACHERS

Tangible incentives	Principals									Teachers								
	Rank of use									Rank of use								
	Most important		Second most		Third most		Not ranked		Total	Most important		Second most		Third most		Not ranked		Total
	N	%	N	%	N	%	N	%	N	N	%	N	%	N	%	N	%	N
Extra pay for special activities	26	26.3	19	19.2	13	13.1	41	41.4	99	76	27.0	51	18.1	45	16.0	109	38.8	281
Salary differential	12	12.1	18	18.2	9	9.1	60	60.6	99	70	24.9	52	18.5	32	11.4	127	45.2	281
College credit	4	4.0	9	9.1	11	11.1	75	75.8	99	27	9.6	29	10.3	34	12.1	191	68.0	281
Released time	15	15.2	24	24.2	18	18.2	42	42.4	99	38	13.5	67	23.8	68	24.2	108	38.4	281
Travel funds	7	7.1	14	14.1	14	14.1	64	64.6	99	17	6.0	30	10.7	33	11.7	201	71.5	281
Participating in workshops and inservice training courses	27	27.3	7	7.1	23	23.2	42	42.4	99	35	12.5	43	15.3	39	13.9	164	58.4	281
Promotion	4	4.0	4	4.0	5	5.1	86	86.9	99	11	3.9	8	2.8	26	9.3	236	84.0	281

Most important = 3 Second most important = 2 Third most important = 1

Promotion

Few of the principals and the teachers considered promotion most important or second most important as an intangible incentive.

Rank Order of the Tangible Incentives

Examination of the data on Table 4.152 indicate that the seven listed tangible incentives, were rated by 4 percent or more of the principals and the teachers as most important.

Principals ranked these tangible incentives in order of importance as follows: (1) participating in workshops and in-service training courses; (2) extra pay for special activities; (3) released time; (4) salary differential; (5) travel funds; (6) college credits; and (7) promotion.

Teachers ranked these tangible incentives in order as follows: (1) extra pay for special activities; (2) salary differential; (3) released time; (4) participating in workshops and inservice training courses; (5) college credit; (6) travel funds; and (7) promotion.

Intangible Incentives

The ten intangible incentives were the following:

Recognition and Prestige of Excellence

Recognition and prestige of excellence was rated most important by 22.4 percent of the principals compared with 20.1 percent of the teachers. Also, 11.2 percent of the principals and 10.4 percent of the teachers considered this incentive important.

Opportunity to Pursue Beliefs and Ideals

Very few of the principals and the teachers considered this

TABLE 4.153

FREQUENCY DISTRIBUTION OF THE RESPONSES OF THE PRINCIPALS AND THE TEACHERS REGARDING THE IMPORTANCE OF SPECIFIC INTANGIBLE INCENTIVES BY PRINCIPALS/TEACHERS

Item	Principals									Teachers								
	Rank of use									Rank of use								
	Most important		Second most		Third most		Not ranked		Total	Most important		Second most		Third most		Not ranked		Total
	N	%	N	%	N	%	N	%	N	N	%	N	%	N	%	N	%	N
Recognition and prestige of excellence	22	22.4	11	11.2	9	9.2	56	57.1	98	56	20.1	29	10.4	36	12.9	157	56.5	278
Opportunity to pursue beliefs and ideals	2	2.0	0	0.0	4	4.1	92	93.9	98	13	4.7	17	6.1	15	5.4	233	83.8	278
Opportunity to pursue new ideas	5	5.1	9	9.2	12	12.2	72	73.5	98	40	14.4	25	9.0	26	9.4	187	67.3	278
Desire to know and understand	5	5.1	6	6.1	6	6.1	81	82.7	98	24	8.6	37	13.3	18	6.5	199	71.6	278
Desire to escape from boredom and routine	1	1.0	5	5.1	2	2.0	90	91.8	98	27	9.7	15	5.4	30	10.8	206	74.1	278
Professional interest or commitment	17	17.3	10	10.2	14	14.3	57	58.2	98	22	7.9	26	9.4	30	10.8	200	71.9	278
Intrinsic satisfaction derived from doing better jobs	13	13.3	17	17.3	19	19.4	49	50.0	98	47	16.9	47	16.9	43	15.5	141	50.7	278
Opportunity for the development of strong and lasting group affiliation based on shared purposes	3	3.1	8	8.2	5	5.1	82	83.7	98	7	2.5	12	4.3	8	2.9	251	90.3	278
Increase sense of influence over educational outcomes	8	8.2	12	12.2	12	12.2	66	67.3	98	22	7.9	36	12.9	23	8.3	197	70.9	278
A possible solution to perceived student needs	22	22.4	20	20.4	15	15.3	41	41.8	98	21	7.6	32	11.5	47	16.9	178	64.0	278

Most important = 3   Second most important = 2   Third most important = 1 important as an intangible incentive.

Opportunity to Pursue New Ideas

Opportunity to pursue new ideas was considered most important by 5.1 percent of the principals and 14.4 percent of the teachers.

Desire to Know and Understand

Desire to know and understand was considered more important by the teachers than by the principals. Approximately 9 percent of the teachers considered this most important as an intangible incentive compared with only 5.1 percent of the principals.

Desire to Escape from Boredom and Routine

Desire to escape from boredom and routine was more important for teachers than for principals. Approximately 10 percent of the teachers rated this most important compared with only 1.0 percent of the principals.

Professional Interest or Commitment

Professional interest or commitment appears to be considered most important as an incentive by more principals than teachers. Over 17 percent of the principals rated it most important compared with only 7.9 percent of the teachers. Also, 10.2 percent of the principals considered it second most important compared with 9.4 percent of the teachers.

Intrinsic Satisfaction Derived from Doing Better Jobs

Intrinsic satisfaction derived from doing better jobs appears to be considered important for both the principals and the teachers.

Approximately 17 percent of the teachers rated this as most important compared with 13.3 percent of the principals. Also, approximately 17 percent of the teachers considered it second most important compared with 17.3 percent of the principals.

Opportunity for the Development of Strong and Lasting Group Affiliation Based on Shared Purposes

A small percentage of both the principals and the teachers considered this important as an intangible incentive. Of the principals responding, 3.1 percent rated this most important, 8.2 percent second most important and 5.1 percent third most important. Of the teachers responding, only 2.5 percent considered this most important, 4.3 percent second most important and 2.9 percent third most important.

Increase Sense of Influence over Educational Outcomes

Increase sense of influence over educational outcomes was rated most important by 8.2 percent of the principals compared with 7.9 percent of the teachers. It was also considered by almost the same percent of the principals and the teachers as the second most important intangible incentive.

A Possible Solution to Perceived Student Needs

This incentive appears to be more important to the principals than to the teachers. It was rated most important by 22.4 percent of the principals compared with approximately 8 percent of the teachers. Also, 20.4 percent of the principals considered it second most important compared with 11.5 percent of the teachers.

Rank Order of Intangible Incentives

Principals

Examination of the data presented in Table 4.153 indicate that seven of the ten intangible incentives were rated by 4.0 percent or more of the principals as most important. These intangible incentives are ranked in order as follows:

(1) a possible solution to perceived student needs; (2) recognition and prestige of excellence; (3) professional interest or commitment; (4) intrinsic satisfaction derived from doing better jobs; (5) increase sense of influence over educational outcomes; (6) opportunity to pursue new ideas; (7) desire to know and understand.

Teachers

Data on Table 4.153 show that nine of the ten intangible incentives were rated by 4.0 percent or more of the teachers as most important. These intangible incentives are ranked in order as follows:

(1) recognition and prestige of excellence; (2) intrinsic satisfaction derived from doing better jobs; (3) opportunity to pursue new ideas; (4) desire to escape from boredom and routine; (5) desire to know and understand; (6) increase sense of influence over educational outcomes; (7) professional interest or commitment; (8) a possible solution to perceived student needs; (9) opportunity to pursue beliefs and ideals.

Science Curriculum Materials

Principals and teachers were asked to indicate what type of science curriculum materials they preferred to use in their schools. Data are presented in Table 4.154. Percentages of each group are presented with regard to the total number of the principals or the teachers responding to each item. Examination of data on Table 4.154 show the following:

Most principals and teachers appeared to prefer a textbook and to supplement with other materials. Approximately 46 percent of the principals and 60 percent of the teachers preferred this approach.

The second preferred approach was using several textbooks; use each when it is most appropriate for the students. About 41 percent of the principals and 26 percent of the teachers preferred this approach.

Teacher developed materials for a local program was third in preference. About 6 percent of the principals and the teachers preferred this approach. Very few teachers or principals preferred the use of a textbook only.

TABLE 4.154

FREQUENCY DISTRIBUTION OF THE RESPONSES OF THE PRINCIPALS AND THE TEACHERS REGARDING THEIR PREFERENCE OF SCIENCE CURRICULUM MATERIALS BY PRINCIPAL/TEACHER

	Principals					Teachers				
	Yes		No		Total	Yes		No		Total
Science material	N	%	N	%	N	N	%	N	%	N
A textbook; use parts and supplement with other materials	45	45.9	53	54.1	98	168	59.8	113	40.2	281
Several textbooks; use each when it is most appropriate for the students	41	41.4	58	58.6	99	72	25.6	209	74.4	281
Teacher developed materials for a local program	6	6.1	92	93.9	98	17	6.0	264	94.0	281
A textbook; use with very little modification	1	1.0	97	99.0	98	9	3.2	272	96.8	281

ASSESSMENT OF SCIENCE TEACHERS

Principals and teachers in the sample were asked to determine the types of activities which usually were taking place or should take place in their science classrooms. The principals were asked to respond as they believed their teachers would respond for what was taking place and respond as they believed for what should take place.

The classroom science activities measured by the CAST: PP and CAST: TP are classified into five categories:

1. What the students do in class?
2. Role of the science teacher in class
3. How the teacher uses the textbook reference materials
4. How the tests are designed and how they are used
5. How the teacher conducts his or her laboratory

Five response options were listed from (a) to (e) for each type of activity (see Appendix B) or they were coded from 5 to 1 (a = 5, b = 4, c = 3, d = 2 and e = 1). The options ranged from extensive student involvement to little involvement. Percentages of each group are presented with regard to the total number of principals or teachers checking each item.

Results measured by the CAST: PP and CAST: TP are presented in Tables 4.155 and 4.156.

Results of the classroom science activities are discussed below:

1. What Do the Students Do in Class?

Data on Tables 4 155 and 4.156 show that, with respect to what the students usually were doing in class, approximately 23 percent of the principals and 14.8 percent of the teachers selected option (a). Also, 34.4 percent of the principals and 39.3 percent of the teachers selected option (b). Option (c) was selected by 31.3 percent of the principals compared with 35.9 percent of the teachers. The mean for the principals was 3.66; the mean for the teachers was 3.57.

On the other hand, as shown in Tables 4.155 and 4.156, high percentages of the principals (46.7 percent) and the teachers (50.5 percent) selected option (a) as what should be done by the students in class. Another 34.8 percent of the principals and 32.8 percent of the teachers also selected option (b) as what should be done by the students in class. The principals' mean was 4.19. The mean for the teachers was 4.31.

The principals and teachers were close in rating what was and should be taking place in class. They both rated what should take place higher than what was taking place.

2. What Is the Role of the Science Teacher in Class?

Data on Tables 4.155 and 4.156 show that, with respect to the role of the science teacher in class, 26 percent of the principals and approximately 37 percent of the teachers selected option (a). Also, about 43 percent of the principals and 40 percent of the teachers selected option (b). Option (c) was selected by approximately 17 percent of the principals compared with about 20 percent of the teachers. The mean for the principals was 3.77. The mean for the teachers was 4.09.

On the other hand, as shown in Tables 4.155 and 4.156, higher percentages of the principals (72.5 percent) and the teachers (69 percent) selected option (a) as what should be the role of the science teacher in class. About 16.5 percent of the principals and 24.3 percent of the teachers also selected option (b) as what should be the role of the science teacher in class. The principals' mean was 4.47. The mean for the teachers was 4.57.

The principals and teachers were close in rating what was and should be the role of the science teacher in class. They both rated what should take place higher than what was taking place.

3. How Does the Science Teacher Use the Textbook and Reference Materials?

Data on Tables 4.155 and 4.156 show that, with respect to how the science teacher usually was using the textbook and reference materials, approximately 17 percent of the principals and 27.5 percent of the teachers selected option (a). Also, approximately 44 percent of the principals and 52 percent of the teachers selected option (b). Option (c) was selected by 32.3 percent of the principals compared with 18.2 percent of the teachers. The mean for the principals was 3.69. The mean for the teachers was 4.05.

As shown in Tables 4.155 and 4.156, higher percentages of the principals (57 percent) and the teachers (54.3 percent) selected option (a) as how should the science teacher use the textbook and reference materials. Also, 29 percent of the principals and 37.5 percent of the teachers indicated that option (b) should take place. The principals' mean was 4.31. The mean for the teachers was 4.41.

The principals and teachers were close in rating how teachers were using and should be using textbooks and reference materials. They both rated what should take place higher than what was taking place.

4. How Are the Tests Designed and How Are They Used?

Data on Tables 4.155 and 4.156 show that, with respect to how tests were designed and how they were used in class, about 24 percent of the principals and 20 percent of the teachers selected option (a). Also, 36.8 percent of the principals and 38.7 percent of the teachers selected option (b). Option (c) was selected by about 34 percent of the principals and 38 percent of the teachers. The mean for the principals was 3.80. The mean for the teachers was 3.75.

As shown in Tables 4.155 and 4.156, higher percentages of the principals (58.1 percent) and the teachers (48.2 percent) selected option (a) as how tests should be designed and should be used in class. About 32.3 percent of the principals and 38.1 percent of the teachers selected option (b) for how tests should be designed and should be used. The principals' mean was 4.40. The mean for the teachers was 4.32.

The principals and teachers were close in rating how the tests were designed and used; and how the tests should be designed and used. They both rated what should take place higher than what was taking place.

5. How Does the Science Teacher Conduct His or Her Laboratory?

Data on Tables 4.155 and 4.156 show that, with respect to how the science teacher usually was conducting his or her laboratory, 25 percent of the principals and about 31 percent of the teachers selected option (a). Also, approximately 43 percent of the principals and 42 percent of the teachers selected option (b). Option (c) was selected by about 27 percent of the principals and 22 percent of the teachers. The mean for the principals was 3.87. The mean for the teachers was 3.98.

As shown in Tables 4.155 and 4.156,higher percentages of the principals (49.5 percent) and the teachers (55.5 percent) selected option (a). About 39.8 percent of the principals and 34.4 percent of the teachers selected option (b). The principals' mean was 4.31. The mean for the teachers was 4.42.

The principals and teachers were close in rating how teachers were and should be using the laboratory. They both rated what should take place higher than what was taking place.

TABLE 4.155

FREQUENCY DISTRIBUTION OF THE PRINCIPAL'S PERCEPTION (CAST: PP) OF THE TEACHER'S ACTIVITIES WHICH USUALLY DO AND SHOULD TAKE PLACE IN THE SCIENCE CLASSROOM

Science classroom activities	Do take place		Should take place	
	Number	Percent	Number	Percent
1. What do the students do in your class?				
a. The students often discuss the problems faced by scientists in the discovery of a scientific principle. They also discuss the kind of evidence that is behind a scientist's conclusions. If the students do not agree with me, I encourage them to say so. The students are frequently given time in class to talk among themselves about ideas in science. They usually do most of the experiments and demonstrations themselves.	22	22.9	43	46.7
b. The students sometimes discuss the problems faced by scientists in the discovery of a scientific principle. They also discuss the evidence that is behind a scientist's conclusions. They sometimes do experiments and demonstrations themselves. They can question what I say.	33	34.4	32	34.8
c. The students infrequently discuss the problems faced by scientists in the discovery of a scientific principle. They spend part of the class time answering my questions. They also write answers to questions from their textbook or study guides. They do some experiments themselves.	30	31.3	10	10.9
d. The students ask questions to clarify what I, or the textbook, have told them. They watch me do demonstrations. They write answers to questions from the textbook or study guides. They answer my questions.	8	8.3	5	5.4
e. The students must copy down and memorize what I tell them. Most of the students' questions are to clear up what I or the textbook has told them. They often write answers to questions from the textbook or study guides.	3	3.1	2	2.2
Total	96	100.0	92	100.0

"Do take place" Mean = 3.66
"Do take place" SD = 1.02

"Should take place" Mean = 4.19
"Should take place" SD = 0.98

TABLE 4.155 (continued)

Science classroom activities	Do take place Number	Do take place Percent	Should take place Number	Should take place Percent
2. What is your role in your classroom?				
a. I help the students understand the general objectives or purposes of a lesson before they begin work on the lesson. I question the students about ideas that the students have studied previously and about the evidence that is behind statements that are made in the textbook. I often ask the students to explain diagrams and graphs.	25	26.0	66	72.5
b. I often question the students about ideas that they have studied previously and about the evidence that is behind statements that are made in the textbook. I sometimes ask the students to explain diagrams and graphs.	41	42.7	15	16.2
c. I spend most of the classtime telling the students about science. I repeat much of what the textbook says. I sometimes question the students about ideas that they have studied.	16	16.7	2	2.2
d. I sometimes repeat exactly what the textbook says. If there is a disagreement among students during a discussion, I usually tell the students who is right. Most of the time I tell the students about science.	11	11.5	3	3.3
e. I show the students that science has almost all of the answers to questions about the natural world. If there is a disagreement among students during a discussion, I tell the students who is right. I often repeat exactly what the textbook says.	3	3.1	5	5.5
Total	96	100.0	91	100.0

"Do take place" Mean = 3.77 "Should take place" Mean = 4.47
"Do take place" SD = 1.06 "Should take place" SD = 1.08

TABLE 4.155 (continued)

Science classroom activities	Do take place Number	Do take place Percent	Should take place Number	Should take place Percent
3. How do you use the textbook and reference materials?				
a. I expect the students to find the major ideas in the textbook and the evidence to support the ideas. I show the students how to question ideas in the textbook. I provide time for the students to read about science in magazines and books other than the textbook.	16	16.7	53	57.0
b. I expect the students to learn some of the details in the textbook. There are books and magazines in the room if the students want to use them. I show the students how to question ideas in the textbook.	42	43.7	27	29.0
c. I expect the students to learn many of the details in the textbook. I have the students look for some of the major ideas in the textbook and the evidence to support the ideas. I sometimes require students to outline parts of the textbook. The only science talked about is from the textbook and my notes.	31	32.3	5	5.4
d. I expect the students to outline part of the textbook. The only science talked about is from the textbook and my notes. I require the students to learn most of the details in the textbook.	6	6.3	5	5.4
e. I do not like the students to question information in the textbook. I often have the students write out definitions to words. I require the students to outline parts of the textbook and to memorize most of the details in the textbook.	1	1.0	3	3.2
Total	96	100.0	93	100.0

"Do take place" Mean = 3.69 "Should take place" Mean = 4.31
"Do take place" SD = 0.86 "Should take place" SD = 1.02

TABLE 4.155 (continued)

Science classroom activities	Do take place Number	Do take place Percent	Should take place Number	Should take place Percent
4. How are your tests designed and how are they used?				
a. My tests have many questions about the laboratory activities. The tests often require the students to figure out answers to new problems. Sometimes the students must find ways of looking for answers to problems. Often they must repeat skills they have learned in the laboratory, such as making observations and interpreting data.	23	24.2	54	58.1
b. My tests have many questions about the laboratory activities. The tests sometimes require the students to figure out answers to new problems. Sometimes the students must repeat skills they have learned in the laboratory, such as making observations and interpreting data.	35	36.8	30	32.3
c. My tests sometimes ask the students to label drawings. The tests sometimes have questions about the laboratory activities. Sometimes the tests require the students to tell about ideas that they have learned previously.	32	33.7	3	3.2
d. My tests often ask the students to write out definitions to words. The tests do not require the use of mathematics to answer the questions. Often the tests require the students to label drawings.	5	5.3	4	4.3
e. My tests often require the students to write out definitions to words. Often the students must label drawings. The tests do not require the use of mathematics to answer the questions. I do not discuss the test questions in class.	0	0.0	2	2.1
Total	96	100.0	93	100.0

"Do take place" Mean = 3.80 "Should take place" Mean = 4.40
"Do take place" SD = 0.87 "Should take place" SD = 0.91

TABLE 4.155 (continued)

Science classroom activities	Do take place		Should take place	
	Number	Percent	Number	Percent
5. How do you conduct your laboratory?				
a. My students and I spend time before an experiment discussing the purposes of the experiment. I often allow the students to try their own ways of doing the laboratory experiment. The students can compare their answers to those of others when they are finished. They are allowed to do the experiments on their own.	24	25.0	46	49.5
b. My students and I spend time before most experiments discussing the purposes of the experiment. The data one student gathers from an experiment are often different from the data gathered by another student. I allow the students to do some experimenting on their own.	41	42.7	37	39.8
c. My students and I sometimes discuss the purposes of an experiment. The students sometimes may compare their answers to those of others when they are finished. I allow less than one-third of classtime for laboratory experiments.	26	27.1	5	5.4
d. I sometimes conduct the laboratory in such a way that the students know the answers to a question before they do an experiment. My students and I seldom discuss the purposes of an experiment. I allow less than one-fourth of the classtime for laboratory experiments.	4	4.2	3	3.2
e. I do not allow students to do experiments on their own. I conduct the laboratory in such a way that the students know the answers to a question before they do the experiment. I do not discuss the purpose of an experiment. I allow very little classtime for laboratory experiments.	1	1.0	2	2.1
Total	96	100.0	93	100.0

"Do take place" Mean = 3.87 "Should take place" Mean = 4.31
"Do take place" SD = 0.88 "Should take place" SD = 0.88

TABLE 4.156

FREQUENCY DISTRIBUTION OF THE TEACHER'S PERCEPTION (CAST: TP) OF THE TEACHER'S ACTIVITIES WHICH USUALLY DO AND SHOULD TAKE PLACE IN THE SCIENCE CLASSROOM

Science classroom activities	Do take place		Should take place	
	Number	Percent	Number	Percent
1. What do the students do in your class?				
a. The students often discuss the problems faced by scientists in the discovery of a scientific principle. They also discuss the kind of evidence that is behind a scientist's conclusions. If the students do not agree with me, I encourage them to say so. The students are frequently given time in class to talk among themselves about ideas in science. They usually do most of the experiments and demonstrations themselves.	40	14.8	131	50.5
b. The students sometimes discuss the problems faced by scientists in the discovery of a scientific principle. They also discuss the evidence that is behind a scientist's conclusions. They sometimes do experiments and demonstrations themselves. They can question what I say.	106	39.3	85	32.8
c. The students infrequently discuss the problems faced by scientists in the discovery of a scientific principle. They spend part of the class time answering my questions. They also write answers to questions from their textbook or study guides. They do some experiments themselves.	97	35.9	37	14.3
d. The students ask questions to clarify what I, or the textbook, have told them. They watch me do demonstrations. They write answers to questions from the textbook or study guides. They answer my questions.	22	8.1	3	1.2
e. The students must copy down and memorize what I tell them. Most of the students' questions are to clear up what I or the textbook has told them. They often write answers to questions from the textbook or study guides.	5	1.9	3	1.2
Total	270	100.0	259	100.0

"Do take place" Mean = 3.57 "Should take place" Mean = 4.31
"Do take place" SD = 0.91 "Should take place" SD = 0.84

TABLE 4.156 (continued)

Science classroom activities	Do take place		Should take place	
	Number	Percent	Number	Percent
3. What is your role in your classroom?				
a. I help the students understand the general objectives or purposes of a lesson before they begin work on the lesson. I question the students about ideas that the students have studied previously and about the evidence that is behind statements that are made in the textbook. I often ask the students to explain diagrams and graphs.	99	36.5	176	69.0
b. I often question the students about ideas that they have studied previously and about the evidence that is behind the statements that are made in the textbook. I sometimes ask the students to explain diagrams and graphs.	109	40.2	62	24.3
c. I spend most of the classtime telling the students about science. I repeat much of what the textbook says. I sometimes question the students about ideas that they have studied.	53	19.6	9	3.5
d. I sometimes repeat exactly what the textbook says. If there is a disagreement among students during a discussion, I usually tell the students who is right. Most of the time I tell the students about science.	7	2.6	3	1.2
e. I show the students that science has almost all of the answers to questions about the natural world. If there is a disagreement among students during a discussion, I tell the students who is right. I often repeat exactly what the textbook says.	3	1.1	5	2.0
Total	271	100.0	255	100.0

"Do take place" Mean = 4.09
"Do take place" SD = 0.87

"Should take place" Mean = 4.57
"Should take place" SD = 0.79

TABLE 4.156 (continued)

Science classroom activities	Do take place		Should take place	
	Number	Percent	Number	Percent
3. How do you use the textbook and reference materials?				
a. I expect the students to find the major ideas in the textbook and the evidence to support the ideas. I show the students how to question ideas in the textbook. I provide time for the students to read about science in magazines and books other than the textbook.	74	27.5	139	54.3
b. I expect the students to learn some of the details in the textbook. There are books and magazines in the room if the students want to use them. I show the students how to question ideas in the textbook.	140	52.0	96	37.5
c. I expect the students to learn many of the details in the textbook. I have the students look for some of the major ideas in the textbook and the evidence to support the ideas. I sometimes require students to outline parts of the textbook. The only science talked about is from the textbook and my notes.	49	18.2	12	4.7
d. I expect the students to outline part of the textbook. The only science talked about is from the textbook and my notes. I require the students to learn most of the details in the textbook.	5	1.9	4	1.6
e. I do not like the students to question information in the textbook. I often have the students write out definitions to words. I require the students to outline parts of the textbook and to memorize most of the details in the textbook.	1	0.4	5	2.0
Total	269	100.0	256	100.0

"Do take place" Mean = 4.05   "Should take place" Mean = 4.41
"Do take place" SD = 0.75   "Should take place" SD = 0.82

TABLE 4.156 (continued)

Science classroom activities	Do take place		Should take place	
	Number	Percent	Number	Percent
4. How are your tests designed and how are they used?				
a. My tests have many questions about the laboratory activities. The tests often require the students to figure out answers to new problems. Sometimes the students must find ways of looking for answers to problems. Often they must repeat skills they have learned in the laboratory, such as making observations and interpreting data.	54	19.9	124	48.2
b. My tests have many questions about the laboratory activities. The tests sometimes require the students to figure out answers to new problems. Sometimes the students must repeat skills they have learned in the laboratory, such as making observations and interpreting data.	105	38.7	98	38.1
c. My tests sometimes ask the students to label drawings. The tests sometimes have questions about the laboratory activities. Sometimes the tests require the students to tell about ideas that they have learned previously.	104	38.4	30	11.7
d. My tests often ask the students to write out definitions to words. The tests do not require the use of mathematics to answer the questions. Often the tests require the students to label drawings.	7	2.6	3	1.2
e. My tests often require the students to write out definitions to words. Often the students must label drawings. The tests do not require the use of mathematics to answer the questions. I do not discuss the test questions in class.	1	0.4	2	0.8
Total	271	100.0	257	100.0

"Do take place" Mean = 3.71
"Do take place" SD = 0.81
"Should take place" Mean = 4.32
"Should take place" SD = 0.79

TABLE 4.156 (continued)

Science classroom activities	Do take place		Should take place	
	Number	Percent	Number	Percent
3. How do you conduct your laboratory?				
a. My students and I spend time before an experiment discussing the purposes of the experiment. I often allow the students to try their own ways of doing the laboratory experiment. The students can compare their answers to those of others when they are finished. They are allowed to do the experiments on their own.	84	31.2	142	55.5
b. My students and I spend time before most experiments discussing the purposes of the experiment. The data one student gathers from an experiment are often different from the data gathered by another student. I allow the students to do some experimenting on their own.	113	42.0	88	34.4
c. My students and I sometimes discuss the purposes of an experiment. The students sometimes may compare their answers to those of others when they are finished. I allow less than one-third of classtime for laboratory experiments.	59	21.9	20	7.8
d. I sometimes conduct the laboratory in such a way that the students know the answers to a question before they do an experiment. My students and I seldom discuss the purposes of an experiment. I allow less than one-fourth of the classtime for laboratory experiments	9	3.3	4	1.5
e. I do not allow students to do experiments on their own. I conduct the laboratory in such a way that the students know the answers to a question before they do the experiment. I do not discuss the purpose of an experiment. I allow very little classtime for laboratory experiments.	4	1.5	2	0.8
Total	269	100.0	256	100.0

"Do take place" Mean = 3.98 "Should take place" Mean = 4.42
"Do take place" SD = 0.90 "Should take place" SD = 0.77

SECTION II

CHANGE IN SCIENCE CURRICULA AND SCHOOL PRACTICES BETWEEN 1979/80 AND 1970/71 SCHOOL YEARS

The results and discussion in this section are organized under the following headings:

1. Common variables in both of the 1970/71 and 1979/80 studies.
2. Change variables between 1979/80 and 1970/71 school years.
3. Relationship between change variables and state control of education.

Common Variables in Both of the 1970/71 and 1979/80 Studies

The common variables in the two OSU studies of 1970/71 and 1979/80, as was stated before in Chapter III, were identified. The identification of these common variables was delimited only to the principal's survey questionnaires of 1970/71 and 1979/80. The 75 common variables used in both of the two principal's survey questionnaires of 1970/71 and 1979/80 are discussed as follows.

School Organization

One hundred public schools, as stated before, were sampled for this study. Data were received from 97 secondary schools. Of the 97 secondary schools that participated in 1979/80, 94 schools were used in examining the change variables. This represents 94 percent of the selected schools. Table 4.157 presents the number and percent of these 94 schools in each region.

TABLE 4.157

FREQUENCY DISTRIBUTION OF THE 94 PUBLIC SECONDARY SCHOOLS BY REGION

Region	Number	Percent
Great Lakes	10	10.6
Farwest	8	8.5
New England	9	9.6
Mideast	10	10.6
Southeast	10	10.6
Rocky Mountains	10	10.6
Plains	20	21.3
Southeast	17	18.2
Total	94	100.0

Types of Schools

The selection of the sampled schools was delimited, as reported before, to three types of schools: (1) schools with grades 7-9, (2) schools with grades 9-12, and (3) schools with grades 10-12. Table 4.158 presents data regarding the types of the 94 selected schools for the 1970/71 and 1979/80 school years. Of the 94 schools, four-year high schools (grades 9-12) accounted for 36.2 percent for the 1970/71 school year compared with 42.6 percent for the 1979/80 school year. Three-year high schools (grades 10-12) accounted for 37.2 percent of the selected schools for the 1970/71 school year compared with 30.8 percent for the 1979/80 school year. Junior high schools (grades 7-9) accounted for 26.6 percent of the selected schools for each of the 1970/71 and 1979/80 school years.

TABLE 4.158

FREQUENCY DISTRIBUTION OF THE TYPE OF SCHOOLS FOR 1970/71 AND 1979/80 SCHOOL YEAR BY TYPE OF SCHOOL ORGANIZATION

	1970/71		1979/80	
School type	Number of schools	Percent of schools	Number of schools	Percent of schools
Grades 7-9	25	26.6	25	26.6
Grades 9-12	34	36.2	40	42.6
Grades 10-12	35	37.2	29	30.8
Total	94	100.0	94	100.0

Student Enrollment

Student enrollments in grades seven through twelve for the 1970/71 and 1979/80 school years are shown in Tables 4.159 through 4.164. Sixty-nine schools were high schools and had no seventh grade or eighth grade (with zero enrollment on Tables 4.159 and 4.160) during each of the 1970/71 and 1979/80 school years. Fifty-nine schools during the 1970/71 school year and 65 schools during the 1979/80 school year had no ninth grade (with zero enrollment on Table 4.161). Twenty-five schools were junior high schools and had no tenth, eleventh or twelfth grades (with zero enrollment on Tables 4.162, 4.163 and 4.164) during each of the 1970/71 and 1979/80 school years. Data show that the mean enrollment in each grade level in all schools became lower during the 1979/80 school year than during the 1970/71 school year.

TABLE 4.159

FREQUENCY DISTRIBUTION OF SEVENTH GRADE STUDENT ENROLLMENTS DURING THE 1970/71 AND 1979/80 SCHOOL YEARS BY SCHOOL

Student enrollments	1970/71 Number of schools	1970/71 Percent of schools	1979/80 Number of schools	1979/80 Percent of schools
0 (No Grade 7)	69	73.4	69	73.4
99 or less	0	0.0	1	1.1
100-199	0	0.0	4	4.2
200-299	7	7.4	12	12.8
300-399	7	7.4	2	2.1
400-499	8	8.5	3	3.2
500-599	0	0.0	1	1.1
600-699	2	2.1	1	1.1
700-799	1	1.1	1	1.1
Total	94	99.9	94	100.1*

Mean enrollment in schools with seventh grade (N = 25) during the 1970/71 school year = 385.5

Mean enrollment in schools with seventh grade (N = 25) during the 1979/80 school year = 305.8

*Percentages may not equal 100 due to rounding.

TABLE 4.160

FREQUENCY DISTRIBUTION OF EIGHTH GRADE STUDENT ENROLLMENTS DURING THE 1970/71 AND 1979/80 SCHOOL YEARS BY SCHOOL

Student enrollments	1970/71 Number of schools	1970/71 Percent of schools	1979/80 Number of schools	1979/80 Percent of schools
0 (No Grade 8)	69	73.4	69	73.4
99 or less	0	0.0	1	1.1
100-199	1	1.1	3	3.2
200-299	6	6.4	12	12.8
300-399	8	8.5	2	2.1
400-499	6	6.4	6	6.4
500-699	3	3.2	1	1.1
700-799	1	1.1	0	0.0
Total	94	100.1	25	100.1*

Mean enrollment in schools with grade eight (N = 25) during the 1970/71 school year = 384.1

Mean enrollment in schools with grade eight (N = 25) during the 1979/80 school year = 301.3

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*Percentages may not equal 100 due to rounding.

TABLE 4.161

FREQUENCY DISTRIBUTION OF NINTH GRADE STUDENT ENROLLMENTS DURING THE 1970/71 AND 1979/80 SCHOOL YEARS BY SCHOOL

	1970/71		1979/80	
Student enrollments	Number of schools	Percent of schools	Number of schools	Percent of schools
0 (No Grade 9)	35	37.2	29	30.9
99 or less	1	1.1	1	1.1
100-199	10	10.6	12	12.8
200-299	11	11.7	18	19.1
300-399	16	17.0	15	16.0
400-499	12	12.8	10	10.6
500-599	3	3.2	4	4.2
600-699	2	2.1	4	4.2
700-799	2	2.1	1	1.1
800-900	2	2.1	0	0.0
Total	94	99.9	94	100.0

Mean enrollment in schools with grade nine (N = 59) during the 1970/71 school year = 360.3

Mean enrollment in schools with grade nine (N = 65) during the 1979/80 school year = 335.0

TABLE 4.162

FREQUENCY DISTRIBUTION OF TENTH GRADE STUDENT ENROLLMENTS DURING THE 1970/71 AND 1979/80 SCHOOL YEARS BY SCHOOL

Student enrollments	1970/71 Number of schools	1970/71 Percent of schools	1979/80 Number of schools	1979/80 Percent of schools
0 (No Grade 10)	25	26.6	25	26.6
99 or less	2	2.1	1	1.1
100-199	8	8.5	9	9.6
200-299	13	13.9	13	13.9
300-399	11	11.7	18	19.1
400-499	7	7.4	6	6.4
500-599	10	10.6	8	8.5
600-699	7	7.4	6	6.4
700-799	7	7.4	4	4.3
800-899	2	2.1	2	2.1
900- up	2	2.1	2	2.1
Total	94	99.8	94	100.1*

Mean enrollment in schools with grade ten (N = 69) during the 1970/71 school year = 467.1	Mean enrollment in schools with grade ten (N = 69) during the 1979/80 school year = 417.4

*Percentages may not equal 100 due to rounding.

TABLE 4.163

FREQUENCY DISTRIBUTION OF ELEVENTH GRADE STUDENT ENROLLMENTS DURING THE 1970/71 AND 1979/80 SCHOOL YEARS BY SCHOOL

	1970/71		1979/80	
Student enrollments	Number of schools	Percent of schools	Number of schools	Percent of schools
0 (No Grade 11)	25	26.6	25	26.6
99 or less	0	0.0	2	2.1
100-199	10	10.6	11	11.7
200-299	20	21.3	16	17.0
300-399	6	6.4	13	13.9
400-499	9	9.6	8	8.5
500-599	9	9.6	9	9.6
600-699	10	10.6	5	5.3
700-799	3	3.2	2	2.1
800-899	0	0.0	2	2.1
900-999	0	0.0	1	1.1
1000- up	2	2.1	0	0.0
Total	94	100.0	94	100.0

Mean enrollment in schools with grade eleven (N = 69) during the 1970/71 school year = 411.6

Mean enrollment in schools with grade eleven (N = 69) during the 1979/80 school year = 378.3

TABLE 4.164

FREQUENCY DISTRIBUTION OF TWELFTH GRADE STUDENT ENROLLMENTS DURING THE 1970/71 AND 1979/80 SCHOOL YEARS BY SCHOOL

	1970/71		1979/80	
Student enrollments	Number of schools	Percent of schools	Number of schools	Percent of schools
0 (No Grade 12)	25	26.6	25	26.6
99 or less	3	3.2	3	3.2
100-199	11	11.7	11	11.7
200-299	18	19.1	23	24.5
300-399	8	8.5	8	8.5
400-499	8	8.5	7	7.4
500-599	7	7.4	10	10.6
600-699	7	7.4	3	3.2
700-799	6	6.4	3	3.2
800-899	1	1.1	1	1.1
900- up	0	0.0	0	0.0
Total	94	99.9	94	100.0

Mean enrollment in schools with grade twelve (N = 69) during the 1970/71 school year = 371.5

Mean enrollment in schools with grade twelve (N = 69) during the 1979/80 school year = 345.8

Total Enrollment

Schools were divided by total enrollment into seven basic groups. Sampled schools were delimited, as reported before, to secondary schools with enrollments of more than 300 students. Schools with student populations of 301 to 499 accounted for 5.3 percent of the selected schools during each of the 1970/71 and 1979/80 school years. Schools with from 500 to 999 students represented about 31 percent during the 1970/71 school year and 35.1 percent during the 1979/80 school year.

Schools with 1,000 to 1,499 students accounted for 27.7 percent during the 1970/71 school year and about 31 percent during the 1979/80 school year. Schools with 1,500 to 1,999 students accounted for about 20 percent during the 1970/71 school year and 17 percent during the 1979/80 school year. Schools with 2,000 to 2,499 accounted for 10.6 percent during the 1970/71 school year and 9.6 percent during the 1979/80 school year. Schools with 2,500 or more students made up 5.3 percent of the selected schools during the 1970/71 school year and 2.1 percent during the 1979/80 school year.

The mean enrollment for students in all the selected schools was about 1,350 students per school during the 1970/71 school year compared with 1,244 students per school during the 1979/80 school year. It appears that there was a decrease in the enrollment of students from the 1970/71 school year to the 1979/80 school year in the selected schools. These data indicate school building changes, not district changes. Several districts experienced large reductions in student enrollment; the buildings do not necessarily reflect those changes.

TABLE 4.165

FREQUENCY DISTRIBUTION OF SCHOOL SIZE BASED ON TOTAL STUDENT ENROLLMENT DURING THE 1970/71 AND 1979/80 SCHOOL YEARS BY SCHOOL

	1970/71		1979/80	
Total enrollment	Number of schools	Percent of schools	Number of schools	Percent of schools
300 or less	0	0.0	0	0.0
301-499	5	5.3	5	5.3
500-999	29	30.9	33	35.1
1000-1499	26	27.7	29	30.9
1500-1999	19	20.2	16	17.0
2000-2499	10	10.6	9	9.6
2500- up	5	5.3	2	2.1
Total	94	100.0	94	100.0

Total Students = 126,891	Total students = 116,955
Mean enrollment in the selected schools during the 1970/71 school year = 1,349.9	Mean enrollment in the selected schools during the 1979/80 school year = 1,244.2

Science Teachers

Number of Science Teachers

Data on Table 4.166 show the number and percentage of male science teachers in the selected schools during the 1970/71 and 1979/80 school years. Approximately 38 percent of the schools had from one to four male science teachers during the 1970/71 school year compared with about 42 percent during the 1979/80 school year. Fifty-one percent had from five to nine male science teachers during the 1970/71 school year compared with about 43 percent during the 1979/80 school year. Only 9.6 percent had from 10 to 14 male science teachers during the 1970/71 school year compared with about 15 percent during the 1979/80 school year. The mean was almost similar during each of the 1970/71 and 1979/80 school year.

TABLE 4.166

FREQUENCY DISTRIBUTION OF MALE SCIENCE TEACHERS DURING THE 1970/71 AND 1979/80 SCHOOL YEARS BY SCHOOL

	1970/71		1979/80	
Number of male science teachers	Number of schools	Percent of schools	Number of schools	Percent of schools
0	0	0.0	1	1.1
1- 4	36	38.3	39	41.5
5- 9	48	51.0	40	42.5
10-14	9	9.6	14	14.9
1[illegible]-up	1	1.1	0	0.0
Total	94	100.0	94	100.0
Mean	5.7		5.8	
SD	2.84		3.22	

Table 4.167 presents the number and percentage of female science teachers in the selected schools during the 1970/71 and 1979/80 school years. About 25 percent of the selected schools had no female science teachers during the 1970/71 school year compared with 18.1 percent during the 1979/80 school year. Sixty-nine percent had from one to four female science teachers during each of the 1970/71 and 1979/80 school years. About 5 percent of the selected schools had from five to nine female science teachers during the 1970/71 school year compared with about 13 percent during the 1979/80 school year. The mean for 1979/80 was higher than that of 1970/71.

TABLE 4.167

FREQUENCY DISTRIBUTION OF FEMALE SCIENCE TEACHERS DURING THE 1970/71 AND 1979/80 SCHOOL YEARS BY SCHOOL

	1970/71		1979/80	
Number of female science teachers	Number of schools	Percent of schools	Number of schools	Percent of schools
0	23	24.5	17	18.1
1- 4	65	69.1	65	69.1
5- 9	5	5.3	12	12.8
10-14	1	1.1	0	0.0
15-70	0	0.0	0	0.0
Total	94	100.0	94	100.0
Mean	1.7		2.0	
SD	1.87		1.81	

Table 4.168 presents the number and percentage of the total number of science teachers in the selected schools during the 1970/71 and 1979/80 school years. Approximately 15 percent of the schools had from one to four science teachers during the 1970/71 school year compared with 20 percent during the 1979/80 school year. Approximately 62 percent of the schools had from five to nine science teachers during the 1970/71 school year compared with 52.1 percent during the 1979/80 school year. About 20 percent of the schools had from 10 to 14 science teachers during the 1970/71 school year compared with 23.4 percent during the 1979/80 school year. Only 3.2 percent of the schools had 15 or more science teachers during the 1970/71 school year compared with 4.2 percent during the 1979/80 school year. The mean is higher for the 1979/80 school year (7.4 for 1970/71 and 7.7 for 1979/80).

TABLE 4.168

FREQUENCY DISTRIBUTION OF TOTAL SCIENCE TEACHERS DURING THE 1970/71 AND 1979/80 SCHOOL YEARS BY SCHOOL

	1970/71		1979/80	
Number of total science teachers	Number of schools	Percent of schools	Number of schools	Percent of schools
0	0	0.0	0	0.0
1- 4	14	14.9	19	20.2
5- 9	58	61.7	49	52.1
10-14	19	20.2	22	23.4
15-up	3	3.2	4	4.2
Total	94	100.0	94	99.9*
Mean	7.4		7.7	
SD	3.30		3.55	

*Percentages may not equal 100 due to rounding.

Percentage of Time Assigned to Teaching Science

Science teaching assignments are shown on Table 4.169. The percentage of science teaching was reported in five equal intervals: 0-20 percent; 21-40 percent; 41-60 percent; 61-80 percent; and 81-100 percent. Most science teachers were teaching science 80 to 100 percent of the time during the 1970/71 and 1979/80 school years. It appears that the percentages for the time assignment (81-100 percent) are almost similar for the 1970/71 and 1979/80 school year.

TABLE 4.169

FREQUENCY DISTRIBUTION OF TEACHERS WITH VARYING ASSIGNMENTS DEVOTED TO SCIENCE TEACHING DURING THE 1970/71 AND 1979/80 SCHOOL YEARS BY REGIONS

Percent of assignment in science and number of teachers	1970/71		1979/80	
0-20 percent	Number of schools	Percent of schools	Number of schools	Percent of schools
0	78	83.0	71	75.5
1-4	15	16.0	23	24.5
5-9	1	1.1	0	0.0
Total	94	100.1	94	100.0
21-40 percent	Number of schools	Percent of schools	Number of schools	Percent of schools
0	75	79.8	72	76.6
1-4	19	20.2	22	23.4
5-9	0	0.0	0	0.0
Total	94	100.0	94	100.0

TABLE 4.169 (CONTINUED)

Percent of assignment in science and number of teachers 41-60 percent	1970/71		1979/80	
	Number of schools	Percent of schools	Number of schools	Percent of schools
0	71	75.5	73	77.7
1-4	23	24.5	21	22.3
5-9	0	0.0	0	0.0
Total	94	100.0	94	100.0
61-80 percent	Number of schools	Percent of schools	Number of schools	Percent of schools
0	83	88.3	79	84.0
1-4	10	10.6	14	14.9
5-9	1	1.1	1	1.1
Total	94	100.0	94	100.0
81-100 percent	Number of schools	Percent of schools	Number of schools	Percent of schools
0	5	5.3	3	3.2
1-4	29	30.9	29	30.9
5-9	46	48.9	46	48.9
10-14	14	14.9	13	13.8
15-up	0	0.0	3	3.2
Total	94	100.0	94	100.0

Financial Support for Science Instruction

Science Budget

Table 4.170 presents data regarding regular annual budgets for science equipment. Of the selected schools, about 72 percent reported a budget for science equipment during the 1970/71 school year compared with 68.1 percent during the 1979/80 school year.

TABLE 4.170

FREQUENCY OF SCHOOLS HAVING ANNUAL BUDGETS FOR NEW SCIENCE EQUIPMENT DURING THE 1970/71 AND 1979/80 SCHOOL YEARS BY SCHOOL

	1970/71		1979/80	
Have equipment budget	Number of schools	Percent of schools	Number of schools	Percent of schools
Yes	68	72.3	64	68.1
No	26	27.7	30	31.9
Total	94	100.0	94	100.0

The amount of money for science equipment budget per student was reported by about 62 percent of those schools that had annual budgets for science equipment during the 1970/71 and 1979/80 school years. Data on Table 4.171 show that the range for the budget for science equipment was from $1.00 to $5.00 per student for 1970/71 compared with a range from $1.00 to $20.00 per student for 1979/80. The mean of the science equipment budget per student was higher for the 1979/80 school year than for 1970/71 school year. The mean was $4.10 per student for 1979/80 compared with $1.81 for 1970/71.

TABLE 4.171

AMOUNT OF SCIENCE EQUIPMENT BUDGETED PER STUDENT FOR THE 1970/71 AND 1979/80 SCHOOL YEARS BY SCHOOL

	1970/71		1979/80	
Budget for equipment per student in dollars	Number of schools	Percent of schools	Number of schools	Percent of schools
1.00	25	59.5	13	32.5
2.00	7	16.7	11	27.5
3.00	4	9.5	1	2.5
4.00	5	11.9	5	12.5
5.00	1	2.4	2	5.0
8.00	0	0.0	1	2.5
10.00	0	0.0	4	10.0
13.00	0	0.0	1	2.5
15.00	0	0.0	1	2.5
20.00	0	0.0	1	2.5
Total	42	100.0	40	100.0
Mean of schools that had budgets	$1.81 per student		$4.10 per student	

Data on Table 4.172 show that approximately 77 percent of the schools had annual budgets for science supplies for the 1970/71 school year compared with about 88 percent for the 1979/80 school year.

TABLE 4.172

FREQUENCY OF SCHOOLS HAVING ANNUAL BUDGETS FOR SCIENCE SUPPLIES DURING THE 1970/71 AND 1979/80 SCHOOL YEARS BY SCHOOL

	1970/71		1979/80	
Have supplies budget	Number of schools	Percent of schools	Number of schools	Percent of schools
Yes	72	76.6	83	88.3
No	22	23.4	11	11.7
Total	94	100.0	94	100.0

The amount of money budgeted for science supplies per student was reported by 65.3 percent of those schools that had annual budgets for science supplies for the 1970/71 school year and by about 71.0 percent for the 1979/80 school year. Data on Table 4.173 show that the range for the budget for purchasing supplies was almost from $1.00 to $6.00 per student for the 1970/71 school year compared with a range from $1.00 to $28.00 per student for the 1979/80 school year. The mean of the science supplies budget per student was higher for the 1979/80 school year than for the 1970/71 school year. The mean was $4.78 per student for 1979/80 compared with $2.19 per student for 1970/71.

TABLE 4.173

AMOUNT OF SCIENCE SUPPLIES BUDGETED PER STUDENT FOR THE 1970/71 AND 1979/80 SCHOOL YEARS BY SCHOOL

Budget for equipment per student in dollars	1970/71		1979/80	
	Number of schools	Percent of schools	Number of schools	Percent of schools
1.00	22	46.8	13	22.0
2.00	14	29.8	10	16.8
3.00	7	14.9	11	18.6
4.00	1	2.1	7	11.9
5.00	0	0.0	4	6.9
6.00	2	4.3	3	5.1
7.00	0	0.0	1	1.7
8.00	0	0.0	1	1.7
10.00	0	0.0	2	3.4
11.00	0	0.0	3	5.1
13.00	0	0.0	1	1.7
16.00	1	2.1	0	0.0
20.00	0	0.0	1	1.7
22.00	0	0.0	1	1.7
28.00	0	0.0	1	1.7
Total	47	100.0	59	100.0
Mean of schools that had budgets	$2.19 per student		$4.78 per student	

Data on Table 4.174 show that 88.3 percent of the schools had funds available for science teachers for buying equipment and supplies during the 1970/71 school year. During the 1979/80 school year, about 86 percent of the schools had funds for this purpose.

TABLE 4.174

FREQUENCY OF SCHOOLS ALLOWING PURCHASE OF EQUIPMENT AND SUPPLIES DURING SCHOOL YEAR BY SCHOOL

	1970/71		1979/80	
Having funds available	Number of schools	Percent of schools	Number of schools	Percent of schools
Yes	83	88.3	81	86.2
No	11	11.7	13	13.8
Total	94	100.0	94	100.0

The mean expenditure per student for science equipment was $1.81 in 1970/71. The mean expenditure per student in 1979/80 was $4.10. In 1970/71 dollars the 1979/80 mean would be $2.05.

The mean expenditure per student for science supplies was $2.19 per student in 1970/71. The mean expenditure per student in 1979/80 was $4.78 per student. In 1970/71 dollars the 1979/80 mean would be $2.39.

The Science Curriculum in Public Secondary Schools

One of the major purposes of this study was to determine the changes in the science courses, projects and materials which have recurred from 1970/71 to 1979/80 school years.

Science Courses

Data with respect to some selected science courses which were used during the 1970/71 and 1979/80 school years are presented as follows.

Biology or Life Science

An examination of data on Table 4.175 shows that 87.1 percent of the schools (grades 7-12) were offering biology or life science courses during the 1970/71 school year, while approximately 96 percent were offering these courses during the 1979/80 school year.

TABLE 4.175

PERCENTAGE OF SCHOOLS OFFERING BIOLOGY OR LIFE SCIENCE DURING THE 1970/71 AND 1979/80 SCHOOL YEARS BY SCHOOL

	1970/71		1979/80	
Offering biology or life science	Number of schools	Percent of schools	Number of schools	Percent of schools
Yes	81	87.1	85	95.5
No	12	12.9	4	4.5
Total	93	100.0	89	100.0

Chemistry

Data on Table 4.176 show that approximately 67 percent of the schools (grades 7-12) were offering chemistry courses during the 1970/71 school year, while about 74 percent were offering these courses during the 1979/80 school year. Examination of the data shows that approximately 90 percent of the high schools were offering chemistry courses during the 1970/71 school year compared with 94.2 percent during the 1979/80 school year.

TABLE 4.176

PERCENTAGE OF SCHOOLS OFFERING CHEMISTRY DURING THE 1970/71 AND 1979/80 SCHOOL YEARS BY SCHOOL

	1970/71		1979/80	
Offering chemistry	Number of schools	Percent of schools	Number of schools	Percent of schools
Yes	62	66.7	65	73.9
No	31	33.3	23	26.1
Total	93	100.0	88	100.0

Physics

Data on Table 4.177 show that approximately 67 percent of the schools (grades 7-12) were offering physics courses during the 1970/71 school year, while about 73 percent were offering physics courses during the 1979/80 school year. Examination of the data shows that approximately 90 percent of the high schools were offering physics courses during the 1970/71 school year compared with 92.8 percent during 1979/80.

TABLE 4.177

PERCENTAGE OF SCHOOLS OFFERING PHYSICS DURING THE 1970/71 AND 1979/80 SCHOOL YEARS BY SCHOOL

	1970/71		1979/80	
Offering physics	Number of schools	Percent of schools	Number of schools	Percent of schools
Yes	62	66.7	64	72.7
No	31	33.3	24	27.3
Total	93	100.0	88	100.0

Physical Science

Examination of data on Table 4.178 shows that approximately 55 percent of the schools (grades 7-12) were offering physical science courses during the 1970/71 school year, while about 59 percent were offering these courses during the 1979/80 school year.

TABLE 4.178

PERCENTAGE OF SCHOOLS OFFERING PHYSICAL SCIENCE DURING THE 1970/71 AND 1979/80 SCHOOL YEARS BY SCHOOL

	1970/71		1979/80	
Offering physical science	Number of students	Percent of students	Number of students	Percent of students
Yes	51	54.8	52	59.1
No	42	45.2	36	40.9
Total	93	100.0	88	100.0

Earth Science

Data on Table 4.179 show that 34.4 percent of schools (grades 7-12) were offering earth science courses during the 1970/71 school year, while 40.1 percent were offering these courses during the 1979/80 school year.

TABLE 4.179

PERCENTAGE OF SCHOOLS OFFERING EARTH SCIENCE DURING THE 1970/71 AND 1979/80 SCHOOL YEARS BY SCHOOL

	1970/71		1979/80	
Offering earth science	Number of schools	Percent of schools	Number of schools	Percent of schools
Yes	32	34.4	36	40.1
No	61	65.6	52	59.9
Total	93	100.0	88	100.0

General Science

Data on Table 4.180 show that approximately 41 percent of the schools (grades 7-12) were offering general science courses during the 1970/71 school year, while 28.4 percent of the schools were offering general science courses during the 1979/80 school year. It appears that the percentage of schools that had general science during the school year 1979/80 is probably lower than 28.4 percent; schools which did not respond to this item probably did not offer general science courses. The decline in general science courses has been substantial.

TABLE 4.180

PERCENTAGE OF SCHOOLS OFFERING GENERAL SCIENCE DURING THE 1970/71 AND 1979/80 SCHOOL YEARS BY SCHOOL

Offering general science	1970/71		1979/80	
	Number of schools	Percent of schools	Number of schools	Percent of schools
Yes	38	40.9	21	28.4
No	55	59.1	53	71.6
Total	93	100.0	74	100.0

Geology

Data on Table 4.181 show that only 3.2 percent of the schools (grades 7-12) were offering geology courses during the 1970/71 school year, while 13.1 percent of the schools were offering geology during the 1979/80 school year. Examination of the data shows that 4.4 percent of the high schools were offering geology courses during the 1970/71 school year compared with 11.6 percent during the 1979/80 school year. The increase in geology courses has been substantial.

TABLE 4.181

PERCENTAGE OF SCHOOLS OFFERING GEOLOGY DURING THE 1970/71 AND 1979/80 SCHOOL YEARS BY SCHOOL

Offering geology	1970/71		1979/80	
	Number of schools	Percent of schools	Number of schools	Percent of schools
Yes	3	3.2	8	13.1
No	90	96.8	53	86.9
Total	93	100.0	61	100.0

Advanced Biology (Second Year)

An examination of the data on Table 4.182 shows that approximately 42 percent of the schools were offering advanced biology courses during the 1970/71 school year, while about 54 percent of the reporting schools were offering these courses during the 1979/80 school year. It appears that the percentage of schools that had advanced biology during the school year 1979/80 is probably lower than 54.1 percent; schools which did not respond to this item probably did not offer advanced biology courses.

TABLE 4.182

PERCENTAGE OF SCHOOLS OFFERING ADVANCED BIOLOGY (SECOND YEAR) DURING THE 1970/71 AND 1979/80 SCHOOL YEARS BY SCHOOL

	1970/71		1979/80	
Offering advanced biology	Number of schools	Percent of schools	Number of schools	Percent of schools
Yes	39	41.9	33	54.1
No	54	58.1	28	45.9
Total	93	100.0	61	100.0

Advanced Chemistry (Second Year)

Data on Table 4.183 show that approximately 23 percent of the schools were offering advanced chemistry courses during the 1970/71 school year, while 57.4 percent of the schools were offering these courses during the 1979/80 school year. It appears that the percentage of schools that had advanced chemistry during the school year 1979/80 is probably lower than 57.4 percent; schools which did not respond to this item probably did not offer advanced chemistry courses. The increase in advanced chemistry courses has been substantial.

TABLE 4.183

PERCENTAGE OF SCHOOLS OFFERING ADVANCED CHEMISTRY (SECOND YEAR) DURING THE 1970/71 AND 1979/80 SCHOOL YEARS BY SCHOOL

	1970/71		1979/80	
Offering advanced chemistry	Number of schools	Percent of schools	Number of schools	Percent of schools
Yes	21	22.6	26	57.4
No	72	77.4	35	42.6
Total	93	100.0	61	100.0

Advanced Physics (Second Year)

Data on Table 4.184 show that only approximately 10 percent of the schools were offering advanced physics courses during the 1970/71 school year, while 18 percent of the schools were offering these courses during the 1979/80. It appears that the percentage of schools that had advanced physics during the school year 1979/80 is probably lower than 18.0 percent; schools which did not respond to this item probably did not offer advanced physics courses.

TABLE 4.184

PERCENTAGE OF SCHOOLS OFFERING ADVANCED PHYSICS (SECOND YEAR) DURING THE 1970/71 AND 1979/80 SCHOOL YEARS BY SCHOOL

	1970/71		1979/80	
Offering advanced physics	Number of schools	Percent of schools	Number of schools	Percent of schools
Yes	9	9.7	11	18.0
No	84	90.3	50	82.0
Total	93	100.0	61	100.0

Honors Science Program

Data on Table 4.185 indicate that approximately 9 percent of the schools (grades 7-12) were offering honors science programs during the 1970/71 school year, while 11.5 percent of the schools were offering these courses during the 1979/80 school year. Examination of the data shows that 11.6 percent of the high schools were offering honors science programs during the 1970/71 school year compared with 10.1 percent during the 1979/80 school year.

TABLE 4.185

PERCENTAGE OF SCHOOLS OFFERING HONORS SCIENCE PROGRAM
DURING THE 1970/71 AND 1979/80 SCHOOL YEARS BY SCHOOL

	1970/71		1979/80	
Offering honors science program	Number of schools	Percent of schools	Number of schools	Percent of schools
Yes	8	8.6	7	11.5
No	85	91.4	54	88.5
Total	93	100.0	61	100.0

Science Course Improvement Projects (SCIP)

Data with respect to some selected Science Course Improvement Projects (SCIP) which were used during the 1970/71 and 1979/80 school years are presented as follows.

Biological Science: An Ecological Approach (BSCS Green)

Data on Table 4.186 indicate that approximately 25 percent of the schools (grades 7-12) were teaching BSCS green biology during the 1970/71 school year, while 27 percent were using the materials during the 1979/80 school year. Examination of the data shows that 33.3 percent of the high schools were offering BSCS green biology during the 1970/71 school year compared with 34.8 percent during the 1979/80 school year.

TABLE 4.186

PERCENTAGE OF SCHOOLS OFFERING BIOLOGICAL SCIENCE: ECOLOGICAL APPROACH (BSCS GREEN) DURING THE 1970/71 AND 1979/80 SCHOOL YEARS BY SCHOOL

	1970/71		1979/80	
Offering BSCS Green	Number of schools	Percent of schools	Number of schools	Percent of schools
Yes	23	24.7	24	27.0
No	70	75.3	65	73.0
Total	93	100.0	89	100.0

Biological Science: An Inquiry into Life (BSCS Yellow)

Data on Table 4.187 show that approximately 22 percent of the schools (grades 7-12) were using BSCS yellow biology during the 1970/71 school year, while only 11.2 percent were using the materials during the 1979/80 school year. Examination of the data shows that about 29.0 percent of the high schools were offering BSCS yellow biology during the 1970/71 school year compared with 14.5 percent during the 1979/80 school year.

TABLE 4.187

PERCENTAGE OF SCHOOLS OFFERING BIOLOGICAL SCIENCE: AN INQUIRY (BSCS YELLOW) DURING THE 1970/71 AND 1979/80 SCHOOL YEARS BY SCHOOL

	1970/71		1979/80	
Offering BSCS Yellow	Number of schools	Percent of schools	Number of schools	Percent of schools
Yes	20	21.5	10	11.2
No	73	78.5	79	88.8
Total	93	100.0	89	100.0

Biological Science: Molecules to Man (BSCS Blue)

Data on Table 4.188 show that approximately 13 percent of the schools (grades 7-12) were using BSCS blue biology during the 1970/71 school year, while only 6.7 percent were using the materials during the 1979/80 school year. Examination of the data shows that 17.4 percent of the high schools were offering BSCS blue biology during the 1970/71 school year compared with 8.7 percent during the 1979/80 school year.

TABLE 4.188

PERCENTAGE OF SCHOOLS OFFERING BIOLOGICAL SCIENCE: MOLECULES TO MAN (BSCS BLUE) DURING THE 1970/71 AND 1979/80 SCHOOL YEARS BY SCHOOL

	1970/71		1979/80	
Offering BSCS Blue	Number of schools	Percent of schools	Number of schools	Percent of schools
Yes	12	12.9	6	6.7
No	81	87.1	83	93.3
Total	93	100.0	89	100.0

Chemical Education Materials Study (CHEM Study)

Data on Table 4.189 show that approximately 26 percent of the schools (grades 7-12) were teaching CHEM Study during the 1970/71 school year, while only about 10 percent were using the materials during the 1979/80 school year. Examination of the data shows that about 35 percent of the high schools were offering CHEM Study during the 1970/71 school year compared with 13.0 percent during the 1979/80 school year.

TABLE 4.189

PERCENTAGE OF SCHOOLS OFFERING CHEM STUDY DURING THE 1970/71 AND 1979/80 SCHOOL YEARS BY SCHOOL

	1970/71		1979/80	
Offering CHEM Study	Number of schools	Percent of schools	Number of schools	Percent of schools
Yes	24	25.8	9	10.2
No	69	74.2	79	89.8
Total	93	100.0	88	100.0

Physical Science Study Committee Physics (PSSC)

Data on Table 4.190 indicate that approximately 26 percent of the schools (grades 7-12) were teaching PSSC during the 1970/71 school year, while only about 16 percent were using the PSSC materials during the 1979/80 school year. Examination of the data shows that about 35 percent of the high schools were offering PSSC during the 1970/71 school year compared with 20.3 percent during the 1979/80 school year.

TABLE 4.190

PERCENTAGE OF SCHOOLS OFFERING PHYSICAL SCIENCE STUDY COMMITTEE PHYSICS DURING THE 1970/71 AND 1979/80 SCHOOL YEARS BY SCHOOL

	1970/71		1979/80	
Offering PSSC	Number of schools	Percent of schools	Number of schools	Percent of schools
Yes	24	25.8	14	15.9
No	69	74.2	74	84.1
Total	93	100.0	88	100.0

The Project Physics (PP)

Data on Table 4.191 show that approximately 13 percent of the schools (grades 7-12) were teaching (PP) during the 1970/71 school year, while about 15 percent were using (PP) materials during the 1979/80 school year. Examination of the data shows that 17.4 percent of the high schools were offering PP during the 1970/71 school year compared with about 19 percent during the 1979/80 school year.

TABLE 4.191

PERCENTAGE OF SCHOOLS OFFERING THE PROJECT PHYSICS (PP) DURING THE 1970/71 AND 1979/80 SCHOOL YEARS BY SCHOOL

Offering PP	1970/71 Number of schools	1970/71 Percent of schools	1979/80 Number of schools	1979/80 Percent of schools
Yes	12	12.9	13	14.8
No	81	87.1	75	85.2
Total	93	100.0	88	100.0

Introductory Physical Science (IPS)

Data on Table 4.192 show that 18.3 percent of the shcools (grades 7-12) were teaching IPS during the 1970/71 school year, while approximately 14 percent were using the IPS materials during the 1979/80 school year.

TABLE 4.192

PERCENTAGE OF SCHOOLS OFFERING INTRODUCTORY PHYSICAL SCIENCE (IPS) DURING THE 1970/71 AND 1979/80 SCHOOL YEARS BY SCHOOL

Offering IPS	1970/71 Number of schools	1970/71 Percent of schools	1979/80 Number of schools	1979/80 Percent of schools
Yes	17	18.3	12	13.6
No	76	81.7	76	86.4
Total	93	100.0	88	100.0

Earth Science Curriculum Project (ESCP)

Data on Table 4.193 indicate that approximately 11 percent of the schools (grades 7-12) were teaching ESCP during the school year of 1970/71, while only 8 percent of the schools were using ESCP materials during the 1979/80 school year.

TABLE 4.193

PERCENTAGE OF SCHOOLS OFFERING EARTH SCIENCE CURRICULUM PROJECT (ESCP) DURING THE 1970/71 AND 1979/80 SCHOOL YEARS BY SCHOOL

	1970/71		1979/80	
Offering ESCP	Number of schools	Percent of schools	Number of schools	Percent of schools
Yes	10	10.8	7	8.0
No	83	89.2	81	92.0
Total	93	100.0	88	100.0

Intermediate Science Curriculum Study (ISCS)

Data on Table 4.194 show that 3.2 percent of the schools (grades 7-12) were teaching ISCS during the 1970/71 school year, while 8 percent were using the ISCS materials during the 1979/80 school year.

TABLE 4.194

PERCENTAGE OF SCHOOLS OFFERING INTERMEDIATE SCIENCE CURRICULUM STUDY (ISCS) DURING THE 1970/71 AND 1979/80 SCHOOL YEARS BY SCHOOL

	1970/71		1979/80	
Offering ISCS	Number of schools	Percent of schools	Number of schools	Percent of schools
Yes	3	3.2	7	8.0
No	90	96.8	81	92.0
Total	93	100.0	88	100.0

ENVIRONMENTAL EDUCATION

Schools Teaching Environmental Education or Conservation Education

Data on Table 4.195 show that during the 1970/71 school year environmental education was being taught in about 59 percent of the schools (grades 7-12), while during the 1979/80 school year environmental education was being taught in approximately 81 percent of the schools.

TABLE 4.195

FREQUENCY OF SCHOOLS TEACHING ENVIRONMENTAL/CONSERVATION EDUCATION DURING THE 1970/71 AND 1979/80 SCHOOL YEARS BY SCHOOL

	1970/71		1979/80	
Offering ED/CE	Number of schools	Percent of schools	Number of schools	Percent of schools
Yes	55	59.1	76	80.9
No	38	40.9	18	19.1
Total	93	100.0	94	100.0

Environmental Education as a Separate Subject

Data regarding schools teaching environmental education as a separate subject in the six grades of secondary schools during the 1970/71 and 1979/80 school years are shown in Table 4.196. Percentages of schools offering environmental education courses by grade level are presented. The data indicate that the percentages of schools teaching environmental education as a separate subject were higher in grades 10, 11 and 12 during the 1979/80 school year than during the 1970/71 school year.

TABLE 4.196

PERCENTAGE OF SCHOOLS TEACHING ENVIRONMENTAL EDUCATION AS A SEPARATE SUBJECT DURING THE 1970/71 AND 1979/80 SCHOOL YEARS BY GRADE LEVEL

Grade Level	1970/71		1979/80	
	Number of schools	Percent of total schools at each grade level	Number of schools	Percent of total schools at each grade level
Grade 7	2	8.0	1	4.0
Grade 8	1	4.0	1	4.0
Grade 9	1	1.7	2	3.1
Grade 10	2	2.9	11	15.9
Grade 11	2	2.9	15	21.7
Grade 12	2	2.9	16	23.2

Environmental Education with Science

Data regarding schools that included units or content in environmental education within the science courses during the 1970/71 and 1979/80 school years are shown by grades in Table 4.197. The data indicate that the percentages of schools teaching environmental education with science were higher in almost all grade levels (except grade 9) during the 1979/80 school year than during the 1970/71 school year. The increases, however, were small.

TABLE 4.197

PERCENTAGE OF SCHOOLS TEACHING ENVIRONMENTAL EDUCATION WITH SCIENCE DURING THE 1970/71 AND 1979/80 SCHOOL YEARS BY GRADE AND BY SCHOOL

	1970/71		1979/80	
Grade Level	Number of schools	Percent of total schools at each grade level	Number of schools	Percent of total schools at each grade level
Grade 7	11	44.0	16	64.0
Grade 8	12	48.0	14	56.0
Grade 9	24	40.1	26	40.0
Grade 10	27	39.1	28	40.6
Grade 11	18	26.1	20	29.0
Grade 12	17	24.6	18	26.1

Environmental Education with Social Studies

Data regarding schools that include units or content in environmental education within the social science courses during the 1970/71 and 1979/80 school years are shown by grades in Table 4.198. The data indicate that the percentage of schools teaching environmental education with social science was the same in grades 7 and 8 during the 1970/71 and 1979/80 school years. However, the percentage was lower in grades 9 through 12 during the 1979/80 school year than during the 1970/71 school year.

TABLE 4.198

PERCENTAGE OF SCHOOLS TEACHING ENVIRONMENTAL EDUCATION WITH SOCIAL STUDIES DURING THE 1970/71 AND 1979/80 SCHOOL YEARS BY GRADE LEVEL AND BY SCHOOL

	1970/71		1979/80	
Grade Level	Number of schools	Percent of total schools at each grade level	Number of schools	Percent of total schools at each grade level
Grade 7	1	4.0	1	4.0
Grade 8	1	4.0	1	4.0
Grade 9	4	6.8	4	6.1
Grade 10	6	8.7	4	6.1
Grade 11	11	15.9	6	8.7
Grade 12	10	14.5	3	4.3

Environmental Education Integrated with Two or More Subjects Including Science

Table 4.199 presents data regarding schools where environmental education was taught with two or more subjects including science during the 1970/71 and 1979/80 school years. The data show that the percentages of schools teaching environmental education integrated with two or more subjects including science in grades 7-9 were lower during the 1970/71 school year than during the 1979/80 school year. However, the percentages in grades 10-12 decreased from the 1970/71 to the 1979/80 school years.

TABLE 4.199

PERCENTAGE OF SCHOOLS TEACHING ENVIRONMENTAL EDUCATION WITH TWO OR MORE SUBJECTS INCLUDING SCIENCE DURING THE 1970/71 AND 1979/80 SCHOOL YEARS BY GRADE LEVEL AND BY SCHOOL

	1970/71		1979/80	
Grade Level	Number of schools	Percent of total schools at each grade level	Number of schools	Percent of total schools at each grade level
Grade 7	1	4.0	2	8.0
Grade 8	1	4.0	2	8.0
Grade 9	1	1.7	3	4.6
Grade 10	8	11.6	2	2.9
Grade 11	7	10.1	1	1.5
Grade 12	6	8.7	2	2.9

Environmental Education Integrated with Two or More Subjects Not Including Science

Table 4.200 presents data regarding schools where environmental education was taught with two or more subjects not including science during the 1970/71 and 1979/80 school years. The data show that environmental education was seldom taught in subject combinations that did not include science during the 1970/71 and 1979/80 school years.

TABLE 4.200

PERCENTAGE OF SCHOOLS TEACHING ENVIRONMENTAL EDUCATION WITH TWO OR MORE SUBJECTS NOT INCLUDING SCIENCE DURING THE 1970/71 AND 1979/80 SCHOOL YEARS BY GRADE LEVEL AND BY SCHOOL

	1970/71		1979/80	
Grade Level	Number of schools	Percent of total schools at each grade level	Number of schools	Percent of total schools at each grade level
Grade 7	0	0.0	0	0.0
Grade 8	0	0.0	0	0.0
Grade 9	0	0.0	0	0.0
Grade 10	0	0.0	1	1.5
Grade 11	0	0.0	1	1.5
Grade 12	0	0.0	2	2.9

CHANGE VARIABLES

Change variables were computed for the common variables in the two studies of 1970/71 and 1979/80, presented previously. The SPSS (1975) and the SAS (1979) computer packages were used to get basic descriptive data for these change variables.

The purpose of this part is to present these change variables to show the changes that have occurred in science curricula and school practices in the selected secondary schools from 1970/71 to 1979/80. Tables 4.201 to 4.236 are arranged to show the changes between 1970/71 and 1979/80. Positive numbers indicate an increase in the status of this item and negative numbers indicate a decrease in the status from 1970/71 to 1979/80.

Student Enrollments

Changes in student enrollments are presented in Table 4.201. It appeared that there was a decrease in the enrollment in each grade level (Grades 7-12) and in the total enrollment of students of the selected schools from 1970/71 to 1979/80.

TABLE 4.201

FREQUENCY OF THE CHANGE IN STUDENT ENROLLMENT BETWEEN 1970/71 and 1979/80 SCHOOL YEARS

Grade Level	Number of schools	Mean enrollment change	SD
7	25	- 79.68	166.14
8	25	- 82.80	134.30
9	54	- 24.07	120.91
10	69	- 49.74	195.90
11	69	- 33.39	133.19
12	69	- 25.68	130.77
Total Enrollment	94	-105.70	406.59

Science Teachers

Changes in Number of Science Teachers

Data on Tables 4.202, 4.203 and 4.204 show that the changes in each of the numbers of female, male and the total of science teachers in the selected schools were minimal. It appeared that there was a slight increase in the number of the three categories of science teachers from 1970/71 to 1979/80.

Changes in Teaching Assignment of Science Teachers

Data on Table 4.205 show the changes in the teaching assignment of science teachers between 1970/71 and 1979/80. It appeared that there was a slight increase in all the categories but 41 to 60 percent in the teaching assignment of science teachers from 1970/71 to 1979/80. A slight decrease was shown in the 41-60 percent category.

TABLE 4.202

FREQUENCY OF THE CHANGE IN MALE SCIENCE TEACHERS BETWEEN 1970/71 AND 1979/80 SCHOOL YEARS

Changes in number of male science teachers	Number of schools	Percent of schools
-5	3	3.2
-4	4	4.3
-3	7	7.5
-2	12	12.9
-1	14	15.1
0	18	19.4
+1	11	11.8
+2	10	10.7
+3	6	6.4
+4	4	4.3
+5	2	2.2
+7	1	1.1
+9	1	1.1
Total	93	100.0

TABLE 4.203

FREQUENCY OF THE CHANGE IN FEMALE SCIENCE TEACHERS BETWEEN 1970/71 AND 1979/80 SCHOOL YEARS

Changes in number of female science teachers	Number of schools	Percent of schools
-10	1	1.1
- 5	1	1.1
- 3	2	2.1
- 2	6	6.5
- 1	10	10.7
0	34	36.5
+ 1	25	26.9
+ 2	5	5.4
+ 3	5	5.4
+ 4	2	2.1
+ 6	1	1.1
+ 7	1	1.1
Total	93	100.0

TABLE 4.204

FREQUENCY OF THE CHANGE IN TOTAL SCIENCE TEACHERS BETWEEN 1970/71 AND 1979/80 SCHOOL YEARS

Changes in number of total science teachers	Number of schools	Percent of schools
-7	1	1.1
-4	4	4.3
-3	6	6.4
-2	10	10.7
-1	12	12.9
0	22	23.7
+1	10	10.7
+2	12	12.9
+3	8	8.6
+4	3	3.2
+5	1	1.1
+6	2	2.2
+7	1	1.1
+8	1	1.1
Total	93	100.0

TABLE 4.205

FREQUENCY DISTRIBUTION OF CHANGE IN TEACHING ASSIGNMENT OF SCIENCE TEACHERS BETWEEN 1970/71 AND 1979/80 SCHOOL YEARS

Change in assignment in teaching science (0-20%)	Number of schools	Percent of schools
-9	1	1.1
-2	5	5.4
-1	7	7.5
0	60	64.5
+1	11	11.8
+2	7	7.5
+3	2	2.2
Total	93	100.0

21-40%	Number of schools	Percent of schools
-3	1	1.1
-2	1	1.1
-1	14	15.1
0	56	60.2
+1	15	16.1
+2	6	6.4
Total	93	100.0

41-60%	Number of schools	Percent of schools
-3	1	1.1
-2	7	7.5
-1	11	11.8
0	58	62.3
+1	13	14.0
+2	2	2.2
+3	1	1.1
Total	93	100.0

TABLE 4.205 (CONTINUED)

61-80%	Number of schools	Percent of schools
-10	1	1.1
- 2	3	3.2
- 1	7	7.5
0	67	72.0
+ 1	9	9.7
+ 2	4	4.3
+ 3	1	1.1
+ 5	1	1.1
Total	93	100.0

81-100%	Number of schools	Percent of schools
- 8	1	1.1
- 7	1	1.1
- 6	1	1.1
- 4	3	3.2
- 3	3	3.2
- 2	9	9.6
- 1	14	15.0
0	20	21.5
+ 1	15	16.1
+ 2	12	12.9
+ 3	5	5.4
+ 4	1	1.1
+ 5	2	2.2
+ 6	2	2.2
+ 8	2	2.2
+12	1	1.1
+18	1	1.1
Total	93	100.1*

*Percentages may not equal 100 due to rounding.

Financial Support for Science Instruction

Changes in Science Budget

Data on Tables 4.206 and 4.208 show that it appeared there was some decrease in the number of secondary schools that had annual budgets for science equipment and some increase in the number of schools that had annual budgets for science supplies from 1970/71 to 1979/80.

Tables 4.207 and 4.209 indicate that the amount of money for science equipment and science supplies per student increased substantially from 1970/71 to 1979/80. If we correct the 1979 data for inflation to reflect the purchasing power of the dollar, the amount is reduced by approximately one-half (U.S. Bureau of Laborer Statistics, monthly data in U.S. Bureau of Economic Analysis, Survey of Current Business). Comparisons indicate that there is no significant change in the purchasing power between 1970 and 1979.

Data on Table 4.210 show that it appeared that there was some decrease in the number of secondary schools having funds available for science teachers for buying science equipment and supplies from 1970/71 to 1979/80.

TABLE 4.212

FREQUENCY DISTRIBUTION OF CHANGE IN SCHOOLS HAVING ANNUAL BUDGETS FOR SCIENCE EQUIPMENT BETWEEN 1970/71 AND 1979/80

Change in having annual budget for science equipment		Number of schools	Percent of schools
Decrease	(-1)	16	17.2
No change	(0)	65	69.9
Increase	(+1)	12	12.9
Total		93	100.0

TABLE 4.207

FREQUENCY DISTRIBUTION OF CHANGE IN AMOUNT OF BUDGET FOR SCIENCE EQUIPMENT PER STUDENT IN DOLLARS BETWEEN 1970/71 AND 1979/80 SCHOOL YEARS

Change in amount of budget for science equipment per student in dollars	Number of schools	Percent of schools
- 2	2	5.0
- 1	4	10.0
0	6	15.0
+ 1	9	22.5
+ 2	4	10.0
+ 3	2	5.0
+ 4	4	10.0
+ 5	1	2.5
+ 8	1	2.5
+ 9	3	7.5
+10	1	2.5
+12	1	2.5
+13	1	2.5
+17	1	2.5
Total	40	100.0
Mean	$2.29	

TABLE 4.208

FREQUENCY DISTRIBUTION OF CHANGE IN SCHOOLS HAVING ANNUAL BUDGET FOR SCIENCE SUPPLIES BETWEEN 1970/71 AND 1979/80 SCHOOL YEARS

Change in having annual budget for science supplies		Number of schools	Percent of schools
Decrease	(-1)	5	5.6
No change	(0)	72	80.9
Increase	(+1)	12	13.5
Total		89	100.0

TABLE 4.209

FREQUENCY DISTRIBUTION OF CHANGE IN AMOUNT OF BUDGET FOR SCIENCE SUPPLIES PER STUDENT IN DOLLARS BETWEEN 1970/71 AND 1979/80 SCHOOL YEARS

Changes in amount of budget for science supplies per student in dollars	Number of schools	Percent of schools
- 3	1	1.7
- 2	1	1.7
- 1	1	1.7
0	10	16.9
+ 1	12	20.3
+ 2	9	34.0
+ 3	6	10.2
+ 4	4	6.8
+ 5	1	1.7
+ 6	4	6.8
+ 7	1	1.7
+ 8	2	3.4
+ 9	1	1.7
+11	2	3.4
+13	1	1.7
+17	1	1.7
+21	1	1.7
+27	1	1.7
Total	59	100.0
Mean		$2.59

TABLE 4.210

FREQUENCY DISTRIBUTION OF CHANGE IN SCHOOLS HAVING FUNDS AVAILABLE FOR SCIENCE TEACHERS FOR BUYING EQUIPMENT AND SUPPLIES BETWEEN 1970/71 AND 1979/80 SCHOOL YEARS

Changes in schools having funds available for purchasing equipment and supplies		Number of schools	Percent of schools
Decrease	(-1)	8	8.7
No change	(0)	79	85.9
Increase	(+1)	5	5.4
Total		92	100.0

The Science Curriculum in Public Secondary Schools

Data on Table 4.211 through 4.230 show the changes in the offering of science courses and programs in the selected schools between 1970/71 and 1979/80. There was some increase in the offering of biology or life science, chemistry, physics, physical science, earth science, geology, advanced chemistry and ISCS; and a slight increase in the offering of advanced biology, advanced physics, honors science program, BSCS Green Version and Project Physics in the selected secondary schools from 1970/71 to 1979/80. There was also: (1) a substantial decrease in the offering of BSCS Yellow Version, CHEM Study and PSSC; (2) some decrease in the offering of general science, BSCS Blue Version and IPS; and (3) a slight decrease in the offering of ESCP in the selected secondary schools from 1970/71 to 1979/80.

TABLE 4.211

FREQUENCY DISTRIBUTION OF CHANGE IN SCHOOLS OFFERING BIOLOGY OR LIFE SCIENCE BETWEEN 1970/71 AND 1979/80 SCHOOL YEARS

Change in offering biology or life science		Number of schools	Percent of schools
Decrease	(-1)	3	3.4
No change	(0)	74	84.1
Increase	(+1)	11	12.5
Total		88	100.0

TABLE 4.212

FREQUENCY DISTRIBUTION OF CHANGE IN SCHOOLS OFFERING CHEMISTRY BETWEEN 1970/71 AND 1979/80 SCHOOL YEARS

Change in offering chemistry		Number of schools	Percent of schools
Decrease	(-1)	3	3.5
No change	(0)	76	87.3
Increase	(+1)	8	9.2
Total		87	100.0

TABLE 4.213

FREQUENCY DISTRIBUTION OF CHANGE IN SCHOOLS OFFERING PHYSICS BETWEEN 1970/71 AND 1979/80 SCHOOL YEARS

Change in offering physics		Number of schools	Percent of schools
Decrease	(-1)	3	3.5
No change	(0)	77	88.5
Increase	(+1)	7	8.0
Total		87	100.0

TABLE 4.214

FREQUENCY DISTRIBUTION OF CHANGE IN SCHOOLS OFFERING PHYSICAL SCIENCE BETWEEN 1970/71 AND 1979/80 SCHOOL YEARS

Change in offering physical science		Number of schools	Percent of schools
Decrease	(-1)	12	13.8
No change	(0)	58	66.7
Increase	(+1)	17	19.5
Total		87	100.0

TABLE 4.215

FREQUENCY DISTRIBUTION OF CHANGE IN SCHOOLS OFFERING EARTH SCIENCE BETWEEN 1970/71 AND 1979/80 SCHOOL YEARS

Change in offering earth science		Number of schools	Percent of schools
Decrease	(-1)	8	9.2
No change	(0)	63	72.4
Increase	(+1)	16	18.4
Total		87	100.0

TABLE 4.216

FREQUENCY DISTRIBUTION OF CHANGE IN SCHOOLS OFFERING GENERAL SCIENCE BETWEEN 1970/71 AND 1979/80 SCHOOL YEARS

Change in offering general science		Number of schools	Percent of schools
Decrease	(-1)	16	21.9
No change	(0)	46	63.0
Increase	(+1)	11	15.1
Total		73	100.0

TABLE 4.217

FREQUENCY DISTRIBUTION OF CHANGE IN SCHOOLS OFFERING GEOLOGY BETWEEN 1970/71 AND 1979/80 SCHOOL YEARS

Change in offering geology		Number of schools	Percent of schools
Decrease	(-1)	2	3.3
No change	(0)	51	85.0
Increase	(+1)	7	11.5
Total		60	100.0

TABLE 4.218

FREQUENCY DISTRIBUTION OF CHANGE IN SCHOOLS OFFERING ADVANCED BIOLOGY (SECOND YEAR) BETWEEN 1970/71 AND 1979/80 SCHOOL YEARS

Change in offering advanced biology (second year)		Number of schools	Percent of schools
Decrease	(-1)	7	11.7
No change	(0)	44	73.4
Increase	(+1)	9	15.0
Total		60	100.0

TABLE 4.219

FREQUENCY DISTRIBUTION OF CHANGE IN SCHOOLS OFFERING ADVANCED CHEMISTRY (SECOND YEAR) BETWEEN 1970/71 AND 1979/80 SCHOOL YEARS

Change in offering advanced chemistry (second year)		Number of schools	Percent of schools
Decrease	(-1)	6	10.0
No change	(0)	41	68.3
Increase	(+1)	13	21.7
Total		60	100.0

TABLE 4.220

FREQUENCY DISTRIBUTION OF CHANGE IN SCHOOLS OFFERING ADVANCED PHYSICS (SECOND YEAR) BETWEEN 1970/71 AND 1979/80 SCHOOL YEARS

Change in offering advanced physics (second year)		Number of schools	Percent of schools
Decrease	(-1)	5	8.3
No change	(0)	48	80.0
Increase	(+1)	7	11.7
Total		60	100.0

TABLE 4.221

FREQUENCY DISTRIBUTION OF CHANGE IN SCHOOLS OFFERING HONORS SCIENCE PROGRAM BETWEEN 1970/71 AND 1979/80 SCHOOL YEARS

Change in offering honors science program		Number of schools	Percent of schools
Decrease	(-1)	5	8.3
No change	(0)	49	81.7
Increase	(+1)	6	10.0
Total		60	100.0

TABLE 4.222

FREQUENCY DISTRIBUTION OF CHANGE IN SCHOOLS OFFERING BIOLOGICAL SCIENCE: AN ECOLOGICAL APPROACH (BSCS GREEN) BETWEEN 1970/71 AND 1979/80 SCHOOL YEARS

Change in Offering BSCS Green		Number of schools	Percent of schools
Decrease	(-1)	7	8.0
No change	(0)	72	81.8
Increase	(+1)	9	10.2
Total		88	100.0

TABLE 4.223

FREQUENCY DISTRIBUTION OF CHANGE IN SCHOOLS OFFERING BIOLOGICAL SCIENCE: AN INQUIRY INTO LIFE (BSCS YELLOW) BETWEEN 1970/71 AND 1979/80 SCHOOL YEARS

Change in offering BSCS Yellow		Number of schools	Percent of schools
Decrease	(-1)	14	15.9
No change	(0)	70	79.6
Increase	(+1)	4	4.5
Total		88	100.0

TABLE 4.224

FREQUENCY DISTRIBUTION OF CHANGE IN SCHOOLS OFFERING CHEMICAL EDUCATION MATERIALS STUDY (CHEM STUDY) BETWEEN 1970/71 AND 1979/80 SCHOOL YEARS

Change in offering CHEM Study		Number of schools	Percent of schools
Decrease	(-1)	17	19.5
No change	(0)	67	77.0
Increase	(+1)	3	3.5
Total		87	100.0

TABLE 4.225

FREQUENCY DISTRIBUTION OF CHANGE IN SCHOOLS OFFERING PHYSICAL SCIENCE STUDY COMMITTEE PHYSICS (PSSC) BETWEEN 1970/71 AND 1979/80 SCHOOL YEARS

Change in offering PSSC		Number of schools	Percent of schools
Decrease	(-1)	13	14.9
No change	(0)	70	80.5
Increase	(+1)	4	4.6
Total		87	100.0

TABLE 4.226

FREQUENCY DISTRIBUTION OF CHANGE IN SCHOOLS OFFERING BIOLOGICAL SCIENCE: MOLECULES TO MAN (BSCS BLUE) BETWEEN 1970/71 AND 1979/80 SCHOOL YEARS

Change in offering BSCS Blue	Number of schools	Percent of schools
Decrease (-1)	7	8.0
No change (0)	78	88.6
Increase (+1)	3	3.4
Total	88	100.0

TABLE 4.227

FREQUENCY DISTRIBUTION OF CHANGE IN SCHOOLS OFFERING THE PROJECT PHYSICS (PP) BETWEEN 1970/71 AND 1979/80 SCHOOL YEARS

Change in offering Project Physics	Number of schools	Percent of schools
Decrease (-1)	6	6.9
No change (0)	74	85.1
Increase (+1)	7	8.0
Total	87	100.0

TABLE 4.228

FREQUENCY DISTRIBUTION OF CHANGE IN SCHOOLS OFFERING INTRODUCTORY PHYSICAL SCIENCE (IPS) BETWEEN 1970/71 AND 1979/80 SCHOOL YEARS

Change in offering IPS		Number of schools	Percent of schools
Decrease	(-1)	8	9.2
No change	(0)	75	86.2
Increase	(+1)	4	4.6
Total		87	100.0

TABLE 4.229

FREQUENCY DISTRIBUTION OF CHANGE IN SCHOOLS OFFERING EARTH SCIENCE CURRICULUM PROJECT (ESCP) BETWEEN 1970/71 AND 1979/80 SCHOOL YEARS

Change in offering ESCP		Number of schools	Percent of schools
Decrease	(-1)	7	8.0
No change	(0)	74	85.1
Increase	(+1)	6	6.9
Total		87	100.0

TABLE 4.230

FREQUENCY DISTRIBUTION OF CHANGE IN SCHOOLS OFFERING INTERMEDIATE SCIENCE CURRICULUM STUDY (ISCS) BETWEEN 1970/71 AND 1979/80 SCHOOL YEARS

Change in offering ISCS		Number of schools	Percent of schools
Decrease	(-1)	1	1.2
No change	(0)	81	93.1
Increase	(+1)	5	5.7
Total		87	100.0

Environmental Education

Changes in the Number of Schools Teaching Environmental or Conservation Education

Data on Table 4.231 show changes in the number of schools offering environmental education or conservation education between 1970/71 and 1979/80. There was a substantial increase in the number of secondary schools (grades 7-12) offering environmental or conservation education from 1970/71 to 1979/80.

TABLE 4.231

FREQUENCY DISTRIBUTION OF CHANGE IN SCHOOLS OFFERING ENVIRONMENTAL EDUCATION OR CONSERVATION EDUCATION BETWEEN 1970/71 AND 1979/80 SCHOOL YEARS

Change in offering ED/CD		Number of schools	Percent of schools
Decrease	(-1)	10	10.7
No change	(0)	53	57.0
Increase	(+1)	30	32.3
Total		93	100.0

Changes in the Offering of Environmental Education as a Separate Subject

Data on Table 4.232 show the changes in schools offering environmental education as a separate subject between 1970/71 and 1979/80. There was essentially no change in grades 7, 8 and 9 and a substantial increase in offering environmental education as a separate subject in grades 10, 11 and 12 from 1970/71 to 1979/80.

TABLE 4.232

FREQUENCY DISTRIBUTION OF CHANGE IN SCHOOLS OFFERING ENVIRONMENTAL EDUCATION AS A SEPARATE SUBJECT BETWEEN 1970/71 AND 1979/80 SCHOOL YEARS

Grade 7		Number of schools	Percent of schools
Decrease	(-1)	2	2.6
No change	(0)	74	96.1
Increase	(+1)	1	1.3
Total		77	100.0
Grade 8		**Number of schools**	**Percent of schools**
Decrease	(-1)	1	1.3
No change	(0)	75	97.4
Increase	(+1)	1	1.3
Total		77	100.0
Grade 9		**Number of schools**	**Percent of schools**
Decrease	(-1)	1	1.3
No change	(0)	74	96.1
Increase	(+1)	2	2.6
Total		77	100.0
Grade 10		**Number of schools**	**Percent of schools**
Decrease	(-1)	1	1.3
No change	(0)	65	84.4
Increase	(+1)	11	14.3
Total		77	100.0

TABLE 4.232 (CONTINUED)

Grade 11		Number of schools	Percent of schools
Decrease	(-1)	0	0.0
No change	(0)	63	81.8
Increase	(+1)	14	18.7
Total		77	100.0

Grade 12		Number of schools	Percent of schools
Decrease	(-1)	0	0.0
No change	(0)	62	80.5
Increase	(+1)	15	19.5
Total		77	100.0

Changes in the Offering of Environmental Education with Science

Data on Table 4.233 show the changes in the offering of environmental education with science between 1970/71 and 1979/80. There was a small increase in offering environmental education with science in grades 7 through 12 from 1970/71 to 1979/80.

TABLE 4.233

FREQUENCY DISTRIBUTION OF CHANGE IN SCHOOLS OFFERING ENVIRONMENTAL EDUCATION WITH SCIENCE BETWEEN 1970/71 AND 1979/80 SCHOOL YEARS

Grade 7		Number of schools	Percent of schools
Decrease	(-1)	4	5.2
No change	(0)	64	83.1
Increase	(+1)	9	11.7
Total		77	100.0

Grade 8		Number of schools	Percent of schools
Decrease	(-1)	3	3.9
No change	(0)	67	87.0
Increase	(+1)	7	9.1
Total		77	100.0

Grade 9		Number of schools	Percent of schools
Decrease	(-1)	9	11.7
No change	(0)	55	71.4
Increase	(+1)	13	16.9
Total		77	100.0

Grade 10		Number of schools	Percent of schools
Decrease	(-1)	12	15.8
No change	(0)	49	63.6
Increase	(+1)	16	20.8
Total		77	100.0

TABLE 4.233 (CONTINUED)

Grade 11		Number of schools	Percent of schools
Decrease	(-1)	10	13.0
No change	(0)	53	68.8
Increase	(+1)	14	18.2
Total		77	100.0

Grade 12		Number of schools	Percent of schools
Decrease	(-1)	9	11.7
No change	(0)	56	72.7
Increase	(+1)	12	15.6
Total		77	100.0

Changes in the Offering of Environmental Education with Social Science

Data on Table 4.234 show the changes in schools offering environmental education with social science between 1970/71 and 1979/80. There was no change in grades 7 through 9, a slight decrease in grade 10 and some decrease in grades 11 and 12 from 1970/71 to 1979/80.

TABLE 4.234

FREQUENCY DISTRIBUTION OF CHANGE IN SCHOOLS OFFERING ENVIRONMENTAL EDUCATION WITH SOCIAL STUDIES BETWEEN 1970/71 AND 1979/80 SCHOOL YEARS

Grade 7		Number of schools	Percent of schools
Decrease	(-1)	1	1.3
No change	(0)	75	97.4
Increase	(+1)	1	1.3
Total		77	100.0

Grade 8		Number of schools	Percent of schools
Decrease	(-1)	1	1.3
No change	(0)	75	97.4
Increase	(+1)	1	1.3
Total		77	100.0

Grade 9		Number of schools	Percent of schools
Decrease	(-1)	4	5.2
No change	(0)	69	89.6
Increase	(+1)	4	5.2
Total		77	100.0

Grade 10		Number of schools	Percent of schools
Decrease	(-1)	5	6.4
No change	(0)	69	89.6
Increase	(+1)	3	3.9
Total		77	100.0

TABLE 4.234 (CONTINUED)

Grade 11		Number of schools	Percent of schools
Decrease	(-1)	10	13.0
No change	(0)	62	80.5
Increase	(+1)	5	6.5
Total		77	100.0

Grade 12		Number of schools	Percent of schools
Decrease	(-1)	8	10.4
No change	(0)	67	87.0
Increase	(+1)	2	2.6
Total		77	100.0

Changes in the Offering of Environmental Education Integrated with Two or More Subjects Including Science

Data on Table 4.235 show the changes in schools offering environmental education integrated with two or more subjects including science between 1970/71 and 1979/80. There was a slight increase in grades 7 through 9 and a slight decrease in grades 10 through 12 from 1970/71 to 1979/80.

TABLE 4.235

FREQUENCY DISTRIBUTION OF CHANGE IN SCHOOLS OFFERING ENVIRONMENTAL EDUCATION INTEGRATED WITH TWO OR MORE SUBJECTS INCLUDING SCIENCE BETWEEN 1970/71 AND 1979/80

Grade 7		Number of schools	Percent of schools
Decrease	(-1)	0	0.0
No change	(0)	75	97.4
Increase	(+1)	2	2.6
Total		77	100.0
Grade 8		**Number of schools**	**Percent of schools**
Decrease	(-1)	0	0.0
No change	(0)	75	97.4
Increase	(+1)	2	2.6
Total		77	100.0
Grade 9		**Number of schools**	**Percent of schools**
Decrease	(-1)	1	1.3
No change	(0)	73	94.8
Increase	(+1)	3	3.9
Total		77	100.0
Grade 10		**Number of schools**	**Percent of schools**
Decrease	(-1)	6	8.0
No change	(0)	67	89.3
Increase	(+1)	2	2.7
Total		75	100.0

TABLE 4.235 (CONTINUED)

Grade 11		Number of schools	Percent of schools
Decrease	(-1)	6	7.8
No change	(0)	70	90.9
Increase	(+1)	1	1.3
Total		77	100.0

Grade 12		Number of schools	Percent of schools
Decrease	(-1)	5	6.4
No change	(0)	70	90.9
Increase	(+1)	2	2.6
Total		77	100.0

Changes in the Offering of Environmental Education Integrated with Two or More Subjects Not Including Science

Data on Table 4.236 show the changes in schools offering environmental education integrated with two or more subjects not including science. There was essentially no change in grades 7 through 12 from 1970/71 to 1979/80.

TABLE 4.236

FREQUENCY DISTRIBUTION OF CHANGE IN SCHOOLS OFFERING ENVIRONMENTAL EDUCATION INTEGRATED WITH TWO OR MORE SUBJECTS NOT INCLUDING SCIENCE BETWEEN 1970/71 AND 1979/80

Grade 7		Number of schools	Percent of schools
Decrease	(-1)	0	0.0
No change	(0)	77	100.0
Increase	(+1)	0	0.0
Total		77	100.0
Grade 8		**Number of schools**	**Percent of schools**
Decrease	(-1)	0	0.0
No change	(0)	77	100.0
Increase	(+1)	0	0.0
Total		77	100.0
Grade 9		**Number of schools**	**Percent of schools**
Decrease	(-1)	0	0.0
No change	(0)	77	100.0
Increase	(+1)	0	0.0
Total		77	100.0
Grade 10		**Number of schools**	**Percent of schools**
Decrease	(-1)	0	0.0
No change	(0)	77	100.0
Increase	(+1)	0	0.0
Total		77	100.0

TABLE 4.236 (CONTINUED)

Grade 11		Number of schools	Percent of schools
Decrease	(-1)	0	0.0
No change	(0)	76	98.7
Increase	(+1)	1	1.3
Total		77	100.0

Grade 12		Number of schools	Percent of schools
Decrease	(-1)	0	0.0
No change	(0)	75	97.4
Increase	(+1)	2	2.6
Total		77	100.0

School Organization

SAS User's Guide (1979) was used to compute changes in the type of schools from 1970/71 to 1979/80 using "Cross Tabulation Tables." Data on the two-way Table 4.237 show these changes. The 94 selected schools of 1979/80 consisted of 40 high schools with grades 9-12, 29 senior high schools with grades 10-12 and 25 junior high schools with grades 7-9. Of the 40 high schools with grades 9-12, only 29 were in the same category (9-12) and 11 were senior high schools with grades 10-12 in the 1970/71 school year. These 29 schools (9-12) represent 85.3 percent of the number of the 9-12 schools of 1979/80 and represent 30.9 percent of the total number of the sample schools.

Of the 29 senior high schools with grades 10-12 of 1979/80, only 24 schools were senior high schools (10-12) and five were high schools with grades 9-12 during the 1970/71 school year. These 24 senior high schools represent 68.8 percent of the number of the 10-12 schools of 1979/80 and represent 25.5 percent of the total number of the sample schools.

Concerning the 25 junior high schools of 1979/80, it appeared that there was no change in the status of these schools from 1970/71 to 1979/80.

Examination of the analysis (Chi-square X^2) shows that there was a significant change in the types of the sample secondary schools from the 1970/71 to 1979/80 school year. The primary change was adding grade 9 to some grade 10-12 schools or removing grade 9 from some grade 9-12 schools.

TABLE 4.237

SCHOOL TYPES OF 1970/71 SCHOOL YEAR BY SCHOOL TYPES OF 1979/80 SCHOOL YEAR

		School types of 1979/80 school year			
		(9-12)	(10-12)	(7-9)	Total
School types of 1970/71 school year	(9-12)	29	5	0	34
		30.9%*	5.3%	0.0%	36.2%
		72.5%**	17.2	0.0%	
	(10-12)	11	24	0	35
		11.7%	25.5%	0.0%	37.2%
		27.5%	82.8%	0.0%	
	(7-9)	0	0	25	25
		0.0%	0.0%	26.6%	26.6%
		0.0%	0.0%	100.0%	
	Total	40	29	25	94
		42.6%	30.8%	26.6%	100.0%

Chi-square (χ^2) = 121.98 DF = 4 Prob = 0.0001

*Percentages with regard to the total number of the sample schools (94).

**Percentages with regard to the number of each category.

Testing the Significance of the Change Variables

A series of t-tests for each of the change variables between 1970/71 and 1979/80 was computed using the SPSS (1975) and the SAS (1979) computer packages. Table 4.238 presents the t-values of the change variables between 1970/71 and 1979/80.

The following variables showed significant increase from 1970/71 to 1979/80.

0.01 Level of Significance or Greater

(1) Teaching environmental education in school
(2) Teaching environmental education separately in Grade 10
(3) Teaching environmental education separately in Grade 11
(4) Teaching environmental education separately in Grade 12.

Between 0.05 and 0.01 Level of Significance

(1) Offering biology or life science

Between 0.10 and 0.05 Level of Significance

(1) Offering earth science
(2) Offering geology
(3) Offering an advanced chemistry course (second year)
(4) Use of ISCS

The following variables showed significant decrease from 1970/71 to 1979/80.

0.01 Level of Significance or Greater

1. Enrollment for Grade 8
2. Use of CHEM Study

Between 0.01 and 0.05 Level of Significance

1. Enrollment for Grade 7
2. Enrollment for Grade 10
3. Enrollment for Grade 11
4. Total enrollment
5. Use of BSCS Yellow Version
6. Use of PSSC

Between 0.05 and 0.10 Level of Significance

1. Enrollment for Grade 12
2. Teaching environmental education with social studies in Grade 12
3. Teaching environmental education integrated with 2 or more subjects including science in Grade 11.

All other variables were not significant. The reader can refer to Table 4.238 to examine these variables.

With respect to the School Organization (School Type) variable, a Chi-square (χ^2) was computed in Table 4.237. Results suggest that there is significant change from 1970/71 to 1979/80 at the 0.0001 level of significance or greater.

TABLE 4.238

DIFFERENCE OF MEANS AND t-VALUES OF CHANGE VARIABLES FROM 1970/71 TO 1979/80

Change Variable	Difference of Means	Standard Deviation	Degrees of Freedom	t-Value	Level of Significance
Student Enrollment					
Enrollment for Grade 7	-79.68	166.14	24	-2.40	0.0246**
Enrollment for Grade 8	-82.80	134.29	24	-3.08	0.0051***
Enrollment for Grade 9					NS
Enrollment for Grade 10	-49.74	195.94	68	-2.11	0.0387**
Enrollment for Grade 11	-33.39	133.19	68	-2.08	0.0411**
Enrollment for Grade 12	-25.68	130.78	68	-1.63	0.1075*
Total Enrollment	-103.70	406.59	93	-2.52	0.0134**
SCIENCE TEACHERS					
Number of Male Science Teachers					NS
Number of Female Science Teachers					NS
Total Number of Science Teachers					NS
Total Number of Science Teachers with 0-20% Assignment					NS
Total Number of Science Teachers with 21-40% Assignment					NS
Total Number of Science Teachers with 41-60% Assignment					NS
Total Number of Science Teachers with 61-80% Assignment					NS
Total Number of Science Teachers with 81-100% Assignment					NS
SCIENCE BUDGET					
Science Equipment Budget					NS
Equipment Budget per Student					NS
Science Supplies Budget					NS
Supplies Budget per Student					NS
Teacher Purchase of Science Equipment and Supplies					NS
COURSE OFFERINGS					
Offering Biology or Life Science	0.09	0.39	87	+2.18	0.0317**
Offering Chemistry					NS
Offering Physics					NS
Offering Physical Science					NS
Offering Earth Science	0.09	0.52	86	+1.65	0.1023*
Offering General Science					NS
Offering Geology	0.08	0.38	59	+1.69	0.0959*
Offering an Advanced Biology Course (Second Year)					NS
Offering an Advanced Chemistry Course (Second Year)	0.12	0.56	59	+1.63	0.1089*

TABLE 4.238 (CONTINUED)

Change Variable	Difference of Means	Standard Deviation	Degrees of Freedom	t-Value	Level of Significance
Offering an Advanced Physics Course (Second Year)					NS
Offering an Honors Science Program					NS
Use of BSCS Green					NS
Use of BSCS Yellow	-0.11	0.44	87	-2.42	0.0175**
Use of BSCS Blue					NS
Use of CHEM Study	-0.16	0.45	86	-3.30	0.0014***
Use of PSSC	-0.10	0.43	86	-2.23	0.0282**
Use of PP					NS
Use of IPS					NS
Use of ESCP					NS
Use of ISCS	0.05	0.26	86	+1.65	0.1028*
ENVIRONMENTAL EDUCATION (EE)					
Teaching EE in School	0.22	0.62	92	+3.33	0.0013***
Teaching EE Separately in Grade 7					NS
Teaching EE Separately in Grade 8					NS
Teaching EE Separately in Grade 9					NS
Teaching EE Separately in Grade 10	0.13	0.38	76	+3.04	0.0033***
Teaching EE Separately in Grade 11	0.18	0.39	76	+4.11	0.0001***
Teaching EE Separately in Grade 12	0.20	0.40	76	+4.29	0.0001***
Teaching EE with Science in Grade 7					NS
Teaching EE with Science in Grade 8					NS
Teaching EE with Science in Grade 9					NS
Teaching EE with Science in Grade 10					NS
Teaching EE with Science in Grade 11					NS
Teaching EE with Science in Grade 12					NS
Teaching EE with Social Studies in Grade 7					NS
Teaching EE with Social Studies in Grade 8					NS
Teaching EE with Social Studies in Grade 9					NS
Teaching EE with Social Studies in Grade 10					NS
Teaching EE with Social Studies in Grade 11					NS
Teaching EE with Social Studies in Grade 12	-0.08	0.35	76	-1.93	0.0573*

TABLE 4.238 (CONTINUED)

Change Variable	Difference of Means	Standard Deviation	Degrees of Freedom	t-Value	Level Significance
Teaching EE with 2 or More Subjects including Science in Grade 7					NS
Teaching EE Integrated with 2 or More Subjects including Science in Grade 8					NS
Teaching EE Integrated with 2 or More Subjects including Science in Grade 9					NS
Teaching EE Integrated with 2 or More Subjects including Science in Grade 10					NS
Teaching EE Integrated with 2 or More Subjects including Science in Grade 11	-0.07	0.30	76	-1.92	0.0583*
Teaching EE Integrated with 2 or More Subjects including Science in Grade 12					NS
Teaching EE Integrated with 2 or More Subjects not including Science in Grade 7					NS
Teaching EE Integrated with 2 or More Subjects not including Science in Grade 8					NS
Teaching EE Integrated with 2 or More Subjects not including Science in Grade 9					NS
Teaching EE Integrated with 2 or More Subjects not including Science in Grade 10					NS
Teaching EE Integrated with 2 or More Subjects not including Science in Grade [illegible]					NS
Teaching EE Integrated with 2 or More Subjects not including Science in Grade 12					NS

***Significant at p 0.01

**Significant at p 0.05

*Significant at p 0.10

NS = not significant

Relationship Between Change Variables and State Control of Education

The extent of state control of education is measured, as stated before, by using the School Centralization Score (SCS) of Wirt. Change variables which showed significant increase or decrease ($p < 0.10$) on t-test (Table 4.238 were only used to test the relationship between change variables and state control of education. Of the 24 significant change variables, nine are continuous and the other 15 are dichotomous.

The two types of analyses used were:

1. Analysis of Variance (ANOVA)

ANOVA using SAS "GLM Procedure Reference" was used to test the differences in the nine continuous variables among states of high, average and low control of education. Results of ANOVA for each of the continuous change variables are presented in Tables 4.239 through 4.245. Results on Table 4.239 revealed that there was a significant difference ($p < 0.002$) in student enrollment for grade seven among states of high, average and low control of education from 1970/71 to 1979/80. Table 4.240 indicates that there was a significant difference ($p < 0.001$) in student enrollment for grade eight among states of high, average and low control of education from 1970/71 to 1979/80. It also appeared (Table 4.245) that there was a significant difference ($p < 0.050$) in the total number of science teachers among states of high, average and low control of education from 1970/71 to 1979/80. No other significant differences in other variables among the three levels of state control of education from 1970/71 to 1979/80 were shown.

Further post-hoc analysis was performed using the Scheffé Test (Kennedy, 1979). It was found that the student enrollment for each of grades seven and eight decreased significantly ($p < 0.001$) in states with low control of education.

The Scheffé Test also indicated the total number of science teachers increased significantly ($p < 0.05$) in the states of low control of education.

TABLE 4.239

ANALYSIS OF VARIANCE FOR CHANGE IN ENROLLMENT FOR GRADE 7 BY STATE CENTRALIZATION SCORES (SCS)

Sources	Degrees of Freedom	Sums of Squares	Mean Squares	F Ratios	Level of Significance
Between Groups	2	119505.51	59752.5	28.73	0.002**
Within Groups	5	10399.09	2079.82	0.07	0.990
Error	17	475701.55	27982.44		
Total	24	605606.15			

**$p < 0.002$.

Means:
High SCS = -30.90
Average SCS = -56.47
Low SCS = -262.67

TABLE 4.240

ANALYSIS OF VARIANCE FOR CHANGE IN ENROLLMENT FOR GRADE 8 BY STATE CENTRALIZATION SCORES (SCS)

Sources	Degrees of Freedom	Sums of Squares	Mean Squares	F Ratios	Level of Significance
Between Groups	2	140400.18	70200.09	35.17	0.001**
Within Groups	5	9979.34	1995.87	0.14	0.981
Error	17	244327.05	14372.18		
Total	24	394706.57			

$^{**}p < 0.001$.

Means:
High SCS = - 9.60
Average SCS = -56.97
Low SCS =-269.83

TABLE 4.241

ANALYSIS OF VARIANCE FOR CHANGE IN ENROLLMENT FOR GRADE 10 BY STATE CENTRALIZATION SCORES (SCS)

Sources	Degrees of Freedom	Sums of Squares	Mean Squares	F Ratios	Level of Significance
Between Groups	2	43217.91	21608.96	0.46	0.648
Within Groups	7	327141.11	46734.44	1.23	0.301
Error	59	2242954.78	38016.18		
Total	68	2613313.70			

Means:
High SCS = -84.10
Average SCS = -62.20
Low SCS = -21.05

TABLE 4.242

ANALYSIS OF VARIANCE FOR CHANGE IN ENROLLMENT FOR GRADE 11 BY STATE CENTRALIZATION SCORES (SCS)

Sources	Degrees of Freedom	Sums of Squares	Mean Squares	F Ratios	Level of Significance
Between Groups	2	35773.63	17886.82	3.16	0.105
Within Groups	7	39569.34	5652.76	0.30	0.951
Error	59	1120172.63	18985.98		
Total	68	1195515.6			

Means: High SCS = -73.27
Average SCS = -19.22
Low SCS = -19.81

TABLE 4.243

ANALYSIS OF VARIANCE FOR CHANGE IN ENROLLMENT FOR GRADE 12 BY STATE CENTRALIZATION SCORES (SCS)

Sources	Degrees of Freedom	Sums of Squares	Mean Squares	F Ratios	Level of Significance
Between Groups	2	25160.33	12580.17	1.42	0.304
Within Groups	7	62175.02	8882.15	0.49	0.837
Error	59	1064677.89	18045.39		
Total	68	1152013.24			

Means: High SCS = -55.47
Average SCS = - 5.05
Low SCS = -28.42

TABLE 4.244

ANALYSIS OF VARIANCE FOR CHANGE IN TOTAL ENROLLMENT BY STATE CENTRALIZATION SCORES (SCS)

Sources	Degrees of Freedom	Sums of Squares	Mean Squares	F Ratios	Level of Significance
Between Groups	2	81224.00	40612.00	0.43	0.669
Within Groups	7	668328.46	95475.49	0.55	0.796
Error	84	14611640.48	173948.10		
Total	93	15361192.94			

Means: High SCS = - 123.23
Average SCS = - 68.90
Low SCS = - 132.38

TABLE 4.245

ANALYSIS OF VARIANCE FOR CHANGE IN TOTAL NUMBER OF SCIENCE TEACHERS BY STATE CENTRALIZATION SCORES (SCS)

Sources	Degrees of Freedom	Sums of Squares	Mean Squares	F Ratios	Level of Significance
Between Groups	2	22.41	11.20	4.89	0.047*
Within Groups	7	17.88	2.55	0.38	0.912
Error	83	559.29	6.74		
Total	92	599.58			

*$p < 0.050$.

Means: High SCS = - 0.52
Average SCS = + 0.45
Low SCS = + 0.76

2. Scattergram Plot

Scattergram graphs (plots) were utilized to show the relationship between the change variables and State Centralization Scores (SCS). The vertical axis represents the SCS and the horizontal axis represents a change variable.

Figures A.1 through A.7 (Appendix E) present the scattergrams of SCS (state control of education) with each of the continuous change variables. The significance of the effect of the SCS on change variables was tested, as reported previously, by using ANOVA.

Plots on Figures A.1 and A.2 (Appendix E) indicate that the states of low SCS (low control of education) had the biggest drops in student enrollment in grades seven and eight from 1970/71 to 1979/80. Plots on Figures A.3 through A.6 (see Appendix E) show no real pattern in the change in the enrollment for grades 10, 11, 12 and the change in the total enrollment from 1970/71 to 1979/80.

Plots on Figure A.7 (see Appendix E) show differences in the change in the number of total science teachers between high and low SCS. States of high SCS tended to have fewer teachers than states of low SCS from 1970/71 to 1979/80.

Figures A.8 through A.21 (Appendix E) present the scattergrams of SCS (state control of education) with each of the 15 dichotomous change variables. Plots on the figures show no real pattern in these change variables from 1970/71 to 1979/80 with respect to the state control of education. Nine of these variables deal with the change in the offering of the following science courses:

Biology or Life Science,
Earth Science,
Geology,
Advanced Chemistry (Second Year),
BSCS Yellow,
CHEMS,
PSSC, and
ISCS.

CHAPTER V

SUMMARY, CONCLUSIONS, IMPLICATIONS AND RECOMMENDATIONS

The purpose of this study was to conduct a longitudinal study in the 1979/80 school year for a sample of public secondary schools (Grades 7-12) which participated in the OSU study of 1970/71. Two main objectives were identified:

1. Status of (a) science teaching; and (b) science teachers' and principals' attitudes toward change in science curricula and school practices during the 1979/80 school year in 100 public secondary schools (Grades 7-12) that participated in the OSU study of 1970/71.
2. Changes that have occurred in science curricula and school practices in the selected schools from 1970/71 to 1979/80, in addition to the relationship between change in science curricula and school practices and state control of education.

Summary

General findings are summarized in a series of statements to describe each of the two major sections of the study. The page numbers between parentheses indicate the section in the study from which the findings were drawn.

I. Status of Science Teaching and Science Teachers' and Principals' Attitudes Toward Change in Practices during the 1979/80 School Year

School Organization and Enrollment

- About 26.0 percent of the schools reporting were junior high schools (Grades 7-9). About 44.0 percent of the schools were high schools with Grades 9-10 and about 30.0 percent of the schools were senior high schools with Grades 10-12. (151)
- Sample schools were delimited to public secondary schools with enrollments of more than 300 students. Most of the schools, nearly 82.0 percent, had enrollments between 500 and 2,000 students. Relatively few schools (about 6.0 percent) had enrollments between 300 and 500 students. Approximately 11.0 percent of the schools had enrollments of more than 2,000 students. (158)

Science Teachers

- Approximately 43.0 percent of the schools had from one to four male science teachers, while about 42.0 percent had from five to nine male science teachers. About 15.0 percent had from 10 to 14 male science teachers. The mean was 5.8 male teachers per school during the 1979/80 school year. (167)
- Approximately 18.0 percent of the schools had no female science teachers, while about 69.0 percent of the schools had from one to four female science teachers. About 9.0 percent of the analyzed schools had from five to nine female science teachers. The mean was 2.0 female teachers per school during the 1979/80 school year. (167)

- About 20.0 percent of the schools had from one to four science teachers, while about 52.0 percent had from five to nine teachers. Approximately 28.0 percent had ten or more science teachers. The mean was 7.8 science teachers per school during the 1979/80 school year. (437)

Financial Support for Science Instruction

- About 69.0 percent of the schools had annual budgets for science equipment, while approximately 89.0 percent had annual budgets for science supplies. (172)
- The mean for schools that had budgets was $3.93 per student for science equipment and $4.66 for science supplies per student during the 1979/80 school year. (172)

Science Course Offerings

- The common course patterns in junior high schools (Grades 7-9) were life science or biology, physical science, earth science and general science. (181)
- The most common courses in grades 10, 11 and 12 were biology or life science, chemistry, physics, physical science, earth science and general science. (181)
- Biology or life science courses were offered in grades 7 through 12, while chemistry and physics were most commonly offered in high schools at grades 10 through 12 during the 1979/80 school year. (181)

- Physical science appeared to be offered primarily in grades 8 and 9. It was also offered by a number of schools in grades 10, 11 and 12; at this level, it usually was offered as a science course for students who did not take chemistry or physics. (189)

- Earth science appeared to be offered more frequently in junior high schools at grades 7 through 9. Earth science courses were also offered by some high schools at grades 10 and 11. (190)

- General science appeared to be offered in secondary schools at all grades. However, junior high schools (Grades 7-9) more frequently offered general science than did high schools (Grades 10-12). (192)

- Other specialized science courses such as advanced biology, advanced chemistry, physiology, oceanography, botany, geology, astronomy and advanced physics were being offered in high schools (Grades 10-12) during the 1979/80 school year. (193)

Science Course Improvement Projects (SCIP)

Some SCIP materials developed with funds from the National Science Foundation (NSF) were used during the 1979/80 school year.

- The BSCS biology materials were the most common NSF project materials used in the high schools. The BSCS Green Version was used by approximately 35.0 percent of the high schools, the BSCS Yellow version was used by about 14.0 percent and the BSCS Blue version was used by about 9.0 percent of the high schools during the 1979/80 school year. (415)

- Thirteen percent of the high schools were using CHEM Study. (415)
- PSSC was used in about 20.0 percent, while Project Physics was used in about 19.0 percent of the high schools during the 1979/80 school year. (415)
- IPS was used by approximately 14.0 percent of the secondary schools (Grades 7-12), while ESCP and ISCS were used by only 8.0 percent of the secondary schools. (415)

Environmental Education

- Environmental/Conservation Education (EE) was being taught in about 80.0 percent of the secondary schools. The most common approach was teaching EE with science. Some efforts to integrate EE with social studies and with two or more subjects including science were reported. (205)
- Secondary schools were offering environmental education as a separate subject in grades 10 11 and 12 more than in grades 7, 8 and 9 during the 1979/80 school year. The percentage was highest (about 22.0 percent) at grade 12 and lowest (about 3.0 percent) at grade 9. (205)
- Secondary schools were offering environmental education with science in grades 7, 8, 9 and 10 more than in grades 11 and 12 during the 1979/80 school year. The percentage was highest (64.0 percent) at grade 7 and lowest (about 26.0 percent) at grade 12. (206)

- Secondary schools were offering environmental education with social studies in grade 9 through grade 12 more than in grades 7 and 8 during the 1979/80 school year. The percentage was highest (about 8.0 percent) at grade 11 and lowest (4.0 percent) at grades 7 and 8. (207)

- Secondary schools were teaching environmental education integrated with two or more subjects including science at grades 7 and 8 more than at grades 9 through 12 during the 1979/80 school year. The percentage was highest (12.0 percent) at grade 7 and lowest (about 1.0 percent) at grade 11. (207)

- Few secondary schools were teaching environmental education integrated with two or more subjects not including science at grades 10 through 12. The highest percentage (about 3.0 percent) was at grade 12 and the lowest (about 1.0 percent) was at grades 10 and 11. (209)

Textbooks

The most commonly used science textbooks during the 1979/80 school year were:

- Junior High Schools
    1. Life Science
        (a) Focus on Life Science (Heimler)
    2. Earth Science
        (a) Focus on Earth Science (Bishop)
        (b) Earth Science: The World We Live In (Namowitz)

3. Physical Science
    (a) Introductory Physical Science (IPS) (Haber-Schaim)
4. Others
    (a) Probing the Natural World (ISCS) (181)

- High Schools

1. Biology
    (a) Modern Biology (Otto)
    (b) Biological Science: An Ecological Approach (BSCS Green)
    (c) Biology (Smallwood)
    (d) Biological Science: An Inquiry into Life (BSCS Yellow)
2. Chemistry
    (a) Modern Chemistry (Metcalfe)
    (b) Chemistry: Experiments and Principles (CHEM Study)
3. Physics
    (a) Modern Physics (Williams)
    (b) PSSC Physics (Haber-Schaim)
    (c) The Project Physics (Rutherford) (181)

Personal Characteristics of the Teachers

- The average age of science teachers in the sample schools was about 36 years. The large majority of the teachers were male (approximately 72.0 percent). About 68.0 percent of the teachers had a Master's degree. (217)

Attendance at National Science Foundation (NSF) Institutes

- Approximately 55 percent of the teachers reporting attended one or more of the NSF Institutes. (222)
- Summer Institutes were the most frequently attended NSF-sponsored activity, while Inservice Institutes were the second most frequently attended activity by the sample science teachers. (222)

Facilities and Equipment for Science Courses

Data were reported regarding availability and use of science facilities.

- Of the equipment surveyed videotape recorders/players were the most frequently available equipment in about 79.0 percent of the secondary schools (Grades 7-12). Computer or computer terminals were the next most frequently available (about 49.0 percent) and broadcast television was the third most frequently available (about 40.0 percent). A number of common items such as film and overhead projectors were not surveyed. (236)
- The auto-tutorial laboratory was the most frequently used facility in secondary schools (about 59 percent). Weather stations were the next most frequently (approximately 46 percent) and land laboratories were the third most frequently used (about 43.0 percent). Use of film and overhead projectors were not surveyed. (236)

Obtaining Information about Recent Curriculum Developments

- More than half of the secondary school teachers (Grades 7-12) in the sample indicated a need for assistance in six areas. These areas are ranked in the following order:
    1. Obtaining information about out-of-school resources
    2. Obtaining information about new teaching methods
    3. Obtaining information about instructional materials
    4. Developing skills to use new science equipment and facilities
    5. Obtaining information about recent curriculum developments
    6. Developing local curriculum materials. (257)

Inservice Education Opportunities

- About 61.0 percent of the science teachers reporting indicated a need for more inservice opportunities.

- With respect to needed types of inservice opportunities, science teaching techniques was desired most frequently, science content next most frequently and change strategies third most frequently by science teachers in the sample. (265)

Learning Activities

- Science teachers indicated lecture-discussion, group laboratory activity, lecture, in-class written assignments, individual laboratory and to a lesser extent instructional films as the most important learning activities. Lecture-discussion was ranked as the most important learning activity. (268)

Teachers' Satisfaction with Science Programs

- The majority of the sample science teachers (about 74.0 percent) were satisfied with their science programs, though a few (about 13 percent) were not. (281)

Attitudes of Principals and Teachers

Decision Making

- Principals and teachers felt that teachers had the most influence in determining the science curriculum for their schools, and the department chairperson had the next most considerable influence. Principals believed that they had the third most influence, while the teachers felt that the central staff (curriculum coordinator or supervisor) had the third most influence. Principals felt that the central staff had the fourth most influence in determining the science curriculum in their schools. (283)
- Concerning the influence each of the specific groups or individuals should have in determining the science curriculum results showed that principals' and teachers' ratings for the four groups that should have considerable influence in determining are similar to what they believed existed. (283)

Changes in Science Curriculum and Instruction

- Principals and science teachers had positive attitudes toward the introduction of new practices and materials in their schools. (292)

- Principals and teachers felt that department chairpersons had the most positive attitudes toward the introduction of new practices and materials, and teachers had the next most positive. (292)

Local, State and Federal Funds

- A majority of both principals and teachers felt more funds were needed from all sources for science materials and programs. Fewer teachers felt that funds should remain the same. (300)

Types of Information about Science Materials and Practices

- Principals and teachers in the sample ranked the usefulness of different types of information. These types of information were about: (1) curriculum; (2) instruction; (3) classroom management; (4) evaluation methodology; (5) policies, standards and regulations; (6) budget and expenditures; and (7) court and judicial decisions related to education.

  Principals valued all types of information (from 1 to 7) consistently, but one, more than teachers. Information about laboratory techniques was the only type of information which was related higher by teachers more than by principals. (315)

Components of Science Education

There were similarities between the principals' and the teachers' responses with respect to the components of science education.

- The first five components of science education ranked by principals were:

  1. Processes of science
  2. Interaction of science and technology
  3. Relationships of self and environment
  4. Interaction of science and society
  5. Factual knowledge: facts, concepts, principles. (338)

- The first five components of science education ranked by teachers were:

  1. Processes of science
  2. Factual knowledge: facts, concepts, principles
  3. Relationships of self and environment
  4. Attitudes toward science
  5. Interaction of science and technology. (338)

- Both the principals and the teachers (about 70 percent) rated the processes of science as the most important component of science education for secondary schools. However, the teachers valued factual knowledge (facts, concepts and principles) more than the principals. The teachers rated factual knowledge the second most important component (about 68 percent) and the principals rated factual knowledge the fifth most important component of science education for secondary schools (57 percent). (338)

Barriers to Change

- More than 10 percent of the principals and of the teachers ranked in order 15 and 23 variables, respectively, as serious problems for change. (345)

- While the teachers and principals agreed on the first four barriers, teachers considered them much more serious than did the principals. These four barriers are:

  1. High costs of curriculum materials
  2. Inadequate student reading ability
  3. Inadequate student mathematics background
  4. Insufficient budget. (354)

Incentives

Tangible Incentives

- Principals ranked seven tangible incentives in order of importance as follows: (1) participating in workshops and in-service training courses; (2) extra pay for special activities; (3) released time; (4) salary differential; (5) travel funds; (6) college credits; and (7) promotion. (361)

- Teachers ranked seven tangible incentives in order as follows: (1) extra pay for special activities; (2) salary differential; (3) released time; (4) participating in workshops and in-service training courses; (5) college credit; (6) travel funds; and (7) promotion. (361)

Intangible Incentives

- Principals ranked seven intangible incentives in order as follows: (1) a possible solution to perceived student needs; (2) recognition and prestige of excellence; (3) professional interest or commitment; (4) intrinsic satisfaction derived from doing better jobs; (5) increased sense of influence over educational outcomes; (6) opportunity to pursue new ideas; (7) desire to know and understand. (364)

- Teachers ranked nine intangible incentives in order as follows: (1) recognition and prestige of excellence; (2) intrinsic satisfaction derived from doing better jobs; (3) opportunity to pursue new ideas; (4) desire to escape from boredom and routine; (5) desire to know and understand; (6) increased sense of influence over educational outcomes; (7) professional interest or commitment; (8) a possible solution to perceived student needs; (9) opportunity to pursue beliefs and ideals. (364)

Science Curriculum Materials

- Most principals and teachers appeared to prefer a textbook and to supplement with other materials. Approximately 46 percent of the principals and 60 percent of the teachers preferred this approach.

  The second preferred approach was using several textbooks; using each when it was most appropriate for the students. About 41 percent of the principals and 26 percent of the teachers preferred this approach.

Teacher developed materials for a local program was third in preference. About 6 percent of the principals and the teachers preferred this approach. Very few teachers or principals preferred the use of a textbook; used with very little modification. (368)

II. Changes in Science Curricula and School Practices from 1970/71 to 1979/80

School Organization and Enrollment

- There was a significant change ($p < 0.01$) in the type of the sample secondary schools from 1970/71 to 1979/80. The primary change was adding grade 9 to some grade 10-12 schools or removing grade 9 from some grade 9-12 schools. (469)

- There was a significant decrease ($p < 0.05$) in the enrollment of grades 7, 8, 10 and 11; and in the total enrollment of students of the secondary schools from 1970/71 to 1979/80.

Financial Support for Science Instruction

- The amount of money for science equipment and for science supplies per student increased significantly ($p < 0.01$) from 1970/71 to 1979/80. (443)

Science Course Offerings

- Data indicated a significant increase (p 0.05) in the offerings of biology or life science. (448)

Science Course Improvement Project (SCIP)

- Data indicated a significant decrease (p 0.05) in the use of BSCS Yellow Version, CHEM Study and PSSC in the secondary schools from 1970/1971 to 1979/80. (443)

Environmental/Conservation Education (EE)

Data showed:

- A significant increase (p 0.01) in the number of secondary schools offerings environmental or conservation education from 1970/71 to 1979/80. (459)
- A significant increase (p 0.01) in the offering of environmental education as a separate subject in grades 10, 11 and 12; and no change in grades 7, 8 and 9 from 1970/71 to 1979/80. (459)

Conclusions and Implications

This section draws conclusions and implications from the data obtained in this study and presents comparisons between this study and the most recent three national studies, funded by the National Science Foundation (NSF) in the late 1970's. Abbreviations are used for each study: (1) OSU for Helgeson, et al. (1977) study of The Ohio State University; (2) RTI for Weiss (1977) study of the Research Triangle Institute, North Carolina; and (3) CSSE for Stake and Easley (1978) study of the University of Illinois-Urbana.

1. Enrollment

This study showed a decrease in the enrollment of all grade levels from 1970/71 to 1979/80. The finding is consistent with all other studies and reflects the general decline of students at the age level enrolled in secondary schools. Due to the substantial drop in enrollment, the total number of students enrolled in science courses also dropped.

The percentage of students enrolled in science courses showed a slight but not significant decrease; these data are consistent with the study of Helgeson, et al. (1977) and raise questions concerning comments by many people about science enrollments. This study indicates science enrollments in these schools have maintained their science enrollments. In fact, more schools showed percentage increases than those showing decreases.

This study indicates science enrollments have declined about the same as the decline of the student population. The lack of enrollment in science after grade 10 has also continued. Less than half the student population of these schools were enrolled in science courses in grades 11 and 12. For people who are concerned about National Assessment of Educational Progress (NAEP) scores and prior national studies that indicate a large number of students (primarily nonscience and noncollege-oriented students) do not enroll in science after grade 10. These data certainly are not encouraging.

2. Teacher Characteristics

The National Science Foundation and other agencies and groups have shown concern about the lack of women teaching science in secondary schools; they are concerned that the lack of women as role models for girls leads to fewer girls taking science courses and also entering vocations requiring science. This study shows an increase (though not significant) in the percentage of female science teachers in these schools since 1970/71. To the extent that these secondary schools are typical of other secondary schools, these data indicate relatively little progress in adding women to secondary school science faculties.

The science teachers in these schools were generally better prepared than the teachers in the 1970/71 sample. Areas where teachers had the weakest science preparation were in the junior high schools and in the earth sciences; these were also weak areas in 1970/71. The data indicate that a substantial number of these teachers are teaching with minimal preparation in the science areas to which they are assigned. Relatively little progress has been made in improving the subject matter background of the teachers with these assignments. The primary responsibility for adequately prepared teachers resides with the local school district.

The local school districts need to consider changing inservice education requirements to require that teachers improve their subject matter background as it relates to their jobs. Perhaps teacher associations should also expect the local school district to help pay for the inservice work of teachers to help them to remove content deficiencies and to enable them to keep updated on new content.

3. Science Curriculum and Instructional Materials

Data in this study reflect little change in the basic school science curriculum, though two changes did occur in these schools between 1970/71 and 1979/80. There was an increase in the number of advanced (second year) science courses. These courses tended to be in the larger high schools, but were also included in the curricula of several smaller high schools. There was also an increase in specialized science courses being offered in the high schools such as oceanography, environmental education, meteorology, etc.

It is apparent that some schools are trying to modify the curriculum though relatively little is being done to change the basic curriculum or the order in which the usual science courses are taught. Alternative courses for grades 11 and 12 may attract more students to science courses but this study does not indicate large enrollment gains to these courses during the past ten years.

This study indicated science classes used a single textbook more in 1980 than in 1971. Data indicated a decrease in the use of multiple textbooks and some decrease in use of supplemental materials. As expected, many NSF-sponsored materials decreased in use and textbooks being used in many classes were older (in years) than those in use in 1970/71. Much of these data reflect the tight financial situation for schools (see section on budget) and the attempt to save funds by reducing purchases.

4. Learning Activities

Data obtained in this study are consistent with the national studies cited earlier. While laboratory (hands-on) activities were used in a substantial number of classrooms, their use has declined and lecture-discussion is increasing as a mode of instruction. The lecture-discussion was the predominant technique used in science classrooms.

These data reflect the purchasing power of school science budgets (which have been nearly flat in purchasing power), the increased emphasis on textbooks, and the concern about NAEP scores in many schools. These practices are likely to increase the learning of facts and some concepts, but are not likely to teach processes of science nor increase many students' interest in science.

5. Financial Support

The data obtained in this study indicate that while the dollar amounts of the school science budgets have increased, the purchasing power of the budgets have been essentially flat; there has been no significant increase in the purchasing power of the budgets between 1970/71 and 1980/81.

This has led to concern among the teachers and administrators regarding funds to purchase supplies and materials. It also relates to the increased emphasis on the single textbook, reduction in laboratory work, increased age of textbooks in use, and reduction in use of supplemental materials.

If this pattern of funding continues it appears that the trends will continue and become more evident. This is most likely in low income rural areas and in large urban areas that appeared to have th lowest budgets.

6. State Control of Education

State control of education was positively related to the number of science courses required by the schools. This indicates both support for the SCS rating as a valid scale and also that state requirements do have an impact on school programs,

However, this study found substantial uniformity across states both in the curriculum and in school practices. Differences within states frequently exceeded differences between states. These findings suggest that while state control on education had an impact on local education programs, there appeared to be national trends and standards and local influences that were also helping or hindering science curriculum and instructional practices and exerting a stronger influence than state regulations and control.

An analysis of the schools in this study suggests that many of the better schools were located in suburbs of major cities or in small cities located in wealthy areas (regardless of state). Many schools have less desirable programs appear to be located in inner cities or poor rural areas. Equalization of educational opportunities and providing good school programs does not appear to be equalized even in states of high financial support of education. Equalization of Support in some states probably has reduced the differences between the low tax base and the high tax base schools.

State control of education related positively to the preparation of teachers. In general, teachers from states with a higher SCS appeared to have more preparation in science to their teachers in states with a low SCS. It appears that if states establish reasonable standards and enforce them that teachers are apt to obtain more content course work.

7. Decision Making Related to Science Curriculum

This study is consistent with the other studies identifying who should be involved in determining the science curriculum for schools and who has been involved in determining science curriculum for schools. Both the principals and the teachers felt the teachers played a major role in determining the science curriculum and perceived that they should. However, a number of principals and teachers in this study were staisfied with their current curricula and many teachers were using textbooks more than five years old. A substantial number of these teachers also were not using laboratory activities. This investigation questions the amount of involvement and amount of time spent by teachers in curriculum improvement; the practices suggest little recent activity in several of the schools. The CSSE case studies raised similar question.

Recommendations for Policies and Future Research

1. This study has found that while state influences are strong, local influences appear to be important in determining many science practices and programs. This study also found that many of these trends

remained constant from 1971 to 1980. It is recommended that a focused follow-up study be completed in approximately another five years to determine changes or lack of changes in the same communities. If strong programs remain strong and weak programs remain weak, state departments of education need to examine their philosophy and programs for equalization of educational opportunities and the development of quality education.

2. A number of schools in this study appear to have science programs which maintain good student enrollment and have teachers and administrators who are excited about their programs. These schools could serve as a sample for a case study to identify unique variables related to good programs. In several cases these schools appear to have maintained good programs for at least a decade.

3. This study found that very few states and very few districts required more than two years of science in grades 9 through 12. It is recommended that some schools that require more than two years of science be studied to determine whether the requirement of three or more years of science helps college-bound and noncollege-bound students understand science and succeed in science-related careers. Items from NAEP and SAT type tests could be used for achievement indices. Other tests could also be used that relate to the school curricula.

4. It is recommended that data obtained in this study be analyzed by multiple correlation techniques to identify the strength of prediction equations related to the status of science teaching in 1980.

These would yield sets of variables that could be examined in future investigations and provide some variables that could be used for intervention in the science program.

5. It is apparent that many schools have teachers who do not have sufficient content background. Inservice education programs should be established by states or local school districts that would remedy this situation. The preparation of junior high school science teachers and earth science teachers continue to be problem areas for most states.

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APPENDIX A

1. School Centralization Scores on 36 Variables, by Regions and Subregions (Wirt, 1977)
2. Wirt Scale (School Centralization Scores by State) (SCS)
3. Form of the data of Schools for 1979-80 school year

TABLE A.1

SCHOOL CENTRALIZATION SCORES ON THIRTY-SIX VARIABLES, BY REGIONS AND SUBREGIONS (Wirt, 1977)

VARIABLE	NORTHEAST	NEW ENGLAND	MID-ATLANTIC	SOUTHEAST	MIDWEST	GREAT LAKES	PLAINS	WEST	SOUTHWEST	MOUNTAIN	FAR WEST	MEAN FOR ALL STATES
Accreditation	-3.90	4.74	-2.90*	+5.70*	4.58	-4.07	+4.94	-3.92	+5.13	-4.39	-2.81	4.50
School calendar	4.21	4.09	+4.35	-3.91	+4.38	4.20	+4.51*	-3.90	-3.68	-3.28	+4.37	4.09
Certification	-4.80	-4.44	5.24	+5.73	5.55	+5.76	5.41	+5.77*	+5.82*	5.67	+5.74	5.49
In-service training	-1.63	-1.67	-1.60	+2.59	-1.74	+2.37	-1.29	+2.31	+3.00	2.00	+3.18	2.09
Salary schedule	-3.14	-2.92	3.40	+4.32*	-2.70	+4.59*	-1.36*	-3.06	-3.00	-2.60	+4.00	3.29
Personnel policies	4.24	+4.59*	-3.82	-3.86	+4.44	+4.61	+4.32	4.13	+4.84*	+4.56	-3.95	4.17
School plant	+3.71	3.51	+3.95*	+4.18*	-2.46*	-2.96	-2.10*	-3.16	-2.08	3.34	+4.84*	3.36
School construction and equipment	+4.09	-3.57	+4.71*	-3.33	+3.92	3.78	+4.02	3.75	-2.00*	+5.63*	3.77	3.76
Safety and health standards	4.23	-3.92*	+4.59	+4.92*	4.35	-3.60	+4.89*	-4.04	+4.98*	4.52	-3.21	4.37
Grade organization	+3.81	-3.08	+4.68*	+4.01*	3.37	+3.93	-2.96	-2.57*	-2.65	-1.55*	+5.06*	3.38
Promotion requirements	-0.50*	-0.00*	1.10	+1.45	1.32	+1.96	-0.86	+1.47	+2.25	-0.20*	+1.50	1.21
Course or credit load	+2.89	-1.55	+4.50*	-1.89	-1.87	-0.60*	2.79	+3.83*	+5.50*	-2.40	+3.25	2.69
Pupil records	3.80	-3.11	+4.63*	3.83	-3.16	-3.01	-3.26	+4.00	-2.46	+3.95	+5.07*	3.71
Textbooks	-3.91	-3.52	4.38	+5.03*	-3.78*	-3.52*	-3.97	+4.57	+5.09*	-4.00	+4.69	4.35
Curriculum	-3.97	4.44	-3.40	+4.78*	4.32	-4.22	4.38	4.50	-3.70	4.45	+4.70	4.41
Extra curricular activities	-1.45	-1.58	-1.30*	+2.66	+3.34*	+3.60	+3.15	2.46	2.45	+2.92	-1.89	2.50
Library	3.59	3.47	+3.73	-3.06	+4.40*	+4.29*	+4.48*	-3.08	-3.00	+3.99	3.57	3.51
Guidance and Counseling	-2.60	-2.52	-2.70	3.14	+3.65	+3.54	+3.73	3.16	-2.87	+3.73	-2.95	3.15
Vocational education	+5.09	+5.12	5.04	+5.49*	-4.40*	-3.77*	4.84	-4.65	5.01	-4.12	-4.40	4.89
Adult education	3.73	3.58	+3.90	+4.34*	-2.86*	-2.62	-3.03	3.61	+4.23	-2.45*	+4.25	3.63
Special education	4.97	4.93	5.01	+5.38*	-4.82*	-4.63*	4.96	5.14	+5.28*	5.23	4.99	5.09
Experimental programs	+2.50	-1.83	+3.30	+3.54*	-1.72	+3.73	-0.28*	-1.43*	-0.95	-1.32	+2.75	2.24

TABLE A.1(Continued)

VARIABLE	NORTHEAST	NEW ENGLAND	MID-ATLANTIC	SOUTHEAST	MIDWEST	GREAT LAKES	PLAINS	WEST	SOUTHWEST	MOUNTAIN	FAR WEST	MEAN FOR ALL STATES
Pupil-teacher ratio	3.08	-2.87	+3.33	+3.67	+3.92*	+3.64	+4.12	-2.02*	-1.25	-2.10	+3.69	3.11
Attendance requirements	-4.16	-3.51*	+4.94	+4.98*	-4.33	-4.66	-4.30	+4.95	-4.04	4.67	+5.68*	4.64
Admission requirements	-3.15	-2.31*	+4.15	+4.34	+4.03	+5.12*	-3.25	3.73	+4.11	2.87	+4.04	3.82
Graduation requirements	-3.87	-3.46	+4.37	4.20	-3.67	-3.80	-3.58	+4.40	+4.80*	-3.06	+5.37*	4.06
School district organization	-2.19*	2.12	-2.26	+4.17	+3.81	+4.03	3.66	+3.93	+4.00	-2.00	+5.25*	4.06
Equal educational opportunity	-2.37*	-1.90*	-2.93	3.70	+3.53	+5.27*	-2.29	+3.60	-2.61	-1.90	+5.63*	3.34
Objectives	-2.14*	-2.58	-1.60*	+3.67	+4.21	+5.30*	3.43	3.50	+4.25	3.50	-3.00	3.41
Pupil transportation	-4.17	-3.96	4.42	4.44	-4.12	4.20	-4.06	+4.56	-3.45	+4.67	+4.91	4.34
Financial records	3.60	-2.61*	+4.79	+4.77	-4.00	-3.30	+4.50	+4.55	+5.34*	+4.93*	4.15	4.26
Accountability	+3.37	3.22	+3.53	+4.02	3.10	3.11	3.10	-2.30	+4.25	-1.20	-1.37	3.14
Evaluation	+3.21	-2.00	+4.67*	-2.81	+3.51	+3.20	3.73	-2.56	+4.25	-1.20	-2.34	2.99
Per pupil expenditure	-1.44*	-1.71	-1.12	2.44	+3.08	+3.19	+3.01	+2.71	+4.22	2.34	-1.50	2.45
Bonds	+1.07	-0.00*	+2.35*	0.50	0.64	-0.00*	+1.09	-0.17*	0.65	-0.00*	-0.00*	0.56
Revenue	-3.12	3.53	-2.62	+4.31	3.62	+4.18	+2.26	-3.28	-3.19	-3.08	+4.44	3.57
Mean	3.27	3.00	3.59	3.87	3.52	3.67	3.41	3.47	3.62	3.16	3.79	3.59

Notes: The scores for the Pacific region are omitted from this table because of the unusual deviation of Hawaii, one state of a two-state set. The scores for the region are included, however, in all reports of means for all states.

- = less than mean SCS for all states by 0.20

+ = more than SCS for all states by 0.20

* indicates a "t" value significant at less than .15.

TABLE A.2

WIRT SCALE

School Centralization Scores (SCS) by State

Number	State	SCS	Number	State	SCS
1	Hawaii	6.00	26	Arkansas	3.57
2	Oklahoma	4.91	27	Maryland	3.56
3	Alabama	4.67	28	Tennessee	3.48
4	South Carolina	4.61	29	Montana	3.47
5	Washington	4.37	30	Utah	3.42
6	Oregon	4.30	31	Kansas	3.38
7	Florida	4.19	32	Alaska	3.38
8	Minnesota	4.10	33	Illinois	3.32
9	West Virginia	3.94	34	Idaho	3.26
10	Mississippi	3.93	35	Georgia	3.24
11	Indiana	3.90	36	Rhode Island	3.21
12	Kentucky	3.90	37	Louisiana	3.19
13	Virginia	3.88	38	Vermont	3.17
14	New Jersey	3.87	39	Delaware	3.15
15	Michigan	3.85	40	New Hampshire	3.13
16	Nebraska	3.81	41	Maine	3.09
17	Iowa	3.80	42	South Dakota	3.08
18	North Carolina	3.80	43	Arizona	2.91
19	Colorado	3.79	44	North Dakota	2.89
20	New Mexico	3.79	45	Texas	2.88
21	Pennsylvania	3.75	46	Missouri	2.84
22	California	3.65	47	Nevada	2.84
23	Ohio	3.65	48	Massachusetts	2.73
24	New York	3.63	49	Connecticut	2.68
25	Wisconsin	3.62	50	Wyoming	1.86

DATA OF SECONDARY SCHOOLS (7-12) FOR 1979-80 SCHOOL YEAR

STATE____________________

	School System	County	Name of School	Address	Principal	Enrollment	Teachers
☐☐ ☐☐☐☐☐☐							
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APPENDIX B

Instruments

1. Status of Science Teaching in Public Secondary Schools in 1979-80 school year: (Q:SP). Principal Questionnaire.
2. Attitudes toward Change in Science Education: (Q:AP). Principal Questionnaire.
3. Checklist for Assessment of Science Teacher: (CAST:PP). Principal's Perception.
4. Status of Science Teaching in Public Secondary Schools in 1979-80 school year: (Q:ST). Science Teacher Questionnaire.
5. Attitudes toward Change in Science Education: (Q:AT). Science Teacher Questionnaire.
6. Checklist for Assessment of Science teacher: (CAST:TP). Teacher's Perception.
7. State Science Supervisor Questionnaire.

SMEAC Information Reference Center
College of Education
The Ohio State University
1200 Chambers Road, Room 310
Columbus, OH 43212

STATUS OF SCIENCE TEACHING IN PUBLIC SECONDARY SCHOOLS

Selected Sample for 1979-80

PRINCIPAL'S QUESTIONNAIRE

Name of School: ____________________

Address of School: ____________________
Number Street
____
City County
____
State Zip Code

General Instructions:

The purpose of this questionnaire is to provide current information about your school and the science courses and projects used in 1979-80.

This questionnaire is to be answered for each individual public secondary school. Please check over the questionnaire before beginning to fill out the form. Check (✓) or complete all items that apply.

I. SCHOOL ORGANIZATION:

1. Check the grade levels that are in this school.

____ 7- 9	____ 10-12
____ 9-12	____ Other (Specify)____

2. Please list the enrollment for each grade level in this school as of Fall 1979.

If you do not have students in a particular grade level, please leave the corresponding space blank.

Enrollment	Grade Level	Enrollment	Grade Level
________	7	________	10
________	8	________	11
________	9	________	12

3. Please indicate the trend in the science enrollment over the past three years in your school (1977-79).

a. Number of students.	____ Decrease ____ No significant change ____ Increase
b. Percentage of school enrollment taking science courses.	____ Decrease ____ No significant change ____ Increase

4. What amount of total science instruction is a student in your school required to complete?

_____ Less than one year
_____ One year
_____ More than one year

If you marked more than one year, please specify what the requirement is: ______________________

5. Are there specific science courses which are required for students in your school? (Circle one). . . . . .Yes No

If yes, please specify required courses.

a. ______________________ c. ______________________
b. ______________________ d. ______________________

II. PRINCIPAL

1. Were you working during the 1970-71 school year at this same school? (Circle one). . .Yes No

If yes, please check the kind of work you were doing.

_____ Administrator
_____ Teacher

2. Please indicate how many years you have been principal of this school. (Count 1979-80 as one year.) _____ Years

III. SCIENCE TEACHERS

1. Specify the total number of regularly employed teachers who teach at least one science subject or course (this includes such courses as electronics, space science, oceanography and photography as well as biology, chemistry, physics, earth science, general science, and physical science).

Number of science teachers _____ Male
_____ Female

2. Please complete the table below to show how many of your science teachers have the following percent of their assignment teaching science.

> **Example:**
> If you have 2 teachers, one male and one female, who teach science 50 percent of the time, please write "1" for the male and "1" for the female in the spaces across from "41-60%".

Percent of Teaching Time Devoted to Science	Number of Teachers Male	Number of Teachers Female
0- 20%	_____	_____
21- 40%	_____	_____
41- 60%	_____	_____
61- 80%	_____	_____
81-100%	_____	_____

IV. SCIENCE BUDGET

For items 1-3 below, the following definitions apply:

Equipment is defined as non-consumable, non-perishable items such as microscopes, chemical balances, models, telescopes, and aquariums.

Supplies are defined as perishable or easily breakable materials that must continually be replenished such as chemicals, dry cells, glassware, electric bulbs, and copper wire.

1. Does your school have an annual budget for the purchase of new science equipment? (Circle one) . . . . .Yes No

   If yes, please specify the amount budgeted per student for 1979-80. . . . . ____ Dollars

2. Does your school have an annual budget for the purchase of supplies? (Circle one). . .Yes No

   If yes, please specify the amount budgeted per student for 1979-80. . . . . ____ Dollars

3. Are your science teachers permitted to purchase equipment and supplies throughout the school year? (Circle one) . . . . . . .Yes No

4. Does your school have an annual budget for the purchase of textbooks? (Circle one) . . . . .Yes No

   If yes, please specify the amount budgeted per student for 1979-80. . . . . ____ Dollars

5. Have you had any budget cuts in your school that have affected the science curriculum? (Circle one) . . . . .Yes No

   If yes, please check the responses that fit your school.

   ______ Class size has increased.
   ______ More teaching from textbooks, less with projects and lab work.
   ______ Less money for instructional materials and equipment.
   ______ Good teachers have been 'let go' and not replaced.
   ______ Optional courses have been reduced in number.

   ______ Inservice training programs have been reduced.
   ______ Students must purchase their own textbooks and/or lab manuals.
   ______ Teachers have been assigned to teach subjects for which they have little or no background preparation.
   ______ Other (Please specify) ______________________________
   ____.

V. COURSE OFFERINGS

1. Please specify the number of students by grade level(s) who are taking the following science courses in your school during the 1979-80 school year. If a textbook is used as a major teaching tool, please specify the number of students by grade level(s) using that text and the year of its publication. If a particular course or textbook is not in use, leave the corresponding spaces blank.

Science Course	Textbook or Course	Year of Publication	Number of Students by Grade Levels					
			7th	8th	9th	10th	11th	12th
Biology or Life Science	1. Biological Science: An Ecological Approach (BSCS Green)							
	2. Biological Science: An Inquiry into Life (BSCS Yellow)							
	3. Biological Science: Interaction of Experiments and Ideas (BSCS)							
	4. Biological Science: Me and My Environment							
	5. Biological Science: Molecules to Man (BSCS Blue)							
	6. Biological Science: Patterns and Processes (BSCS)							
	7. Biology: Introduction to Life (Nason)							
	8. Biology: Living Systems (Oram)							
	9. Biology (Kroeber)							
	10. Biology (Smallwood)							
	11. Focus on Life Science (Heimler)							
	12. Human Sciences Program (BSCS)							
	13. Interaction of Man and the Biosphere: Inquiry in Life Science (Abraham)							
	14. Life in the Environment (Navarra)							
	15. Life: Its Forms and Changes							
	16. Living Things (Fitzpatrick)							
	17. Modern Biology (Otto)							
	18. Other Biology or Life Science Text or Course (Specify)							
	______________________________							
	______________________________							
Chemistry	1. Chemistry: An Experimental Science (Primentel)							
	2. Chemistry: An Investigative Approach (Cotton)							
	3. Chemistry: Experiments and Principles (CHEM Study)							
	4. Chemistry (Sienko)							
	5. Interdisciplinary Approach to Chemistry (IAC)							
	6. Modern Chemistry (Metcalfe)							
	7. Other Chemistry Text or Course (Specify)							
	______________________________							
	______________________________							

Question 1 continues next page.

Science Course	Textbook or Course	Year of Publication	Number of Students by Grade Levels					
			7th	8th	9th	10th	11th	12th
Physics	1. College Physics (Schaum)							
	2. Modern Physics (Williams)							
	3. PSSC Physics (Haber-Schaim)							
	4. The Project Physics (Rutherford)							
	5. Other Physics Text or Course (Specify)							
	______________________________							
	______________________________							
Physical Science	1. Interaction of Matter and Energy: Inquiry in Physical Science (Abraham)							
	2. Introductory Physical Science (IPS)(Haber-Schaim)							
	3. Modern Physical Science (Tracy)							
	4. Physical Science II (PS II) (Haber-Schaim)							
	5. The Man Made World (ECCP)							
	6. Other Physical Science Text or Course (Specify)							
	______________________________							
	______________________________							
Earth Science	1. Earth Science: The World We Live In (Namowitz).							
	2. Focus on Earth Science (Bishop)							
	3. Investigating the Earth (ESCP).							
	4. Modern Earth Science (Ramsey)							
	5. Time, Space and Matter (TSM).							
	6. Other Earth Science Text or Course (Specify)							
	______________________________							
	______________________________							
Other Courses or Text-books	1. Individualized Science Instructional System (ISIS) (Burkman)							
	2. Modern Science Series (Blanc)							
	3. Principles of Science Series (Heimler).							
	4. Probing the Natural World (ISCS)							
	5. Study Lessons in General Science (Gross)							
	6. Other Texts or Courses (Specify)							
	______________________________							
	______________________________							

3. Does your school offer a general science course? (Circle one). . . . . Yes No

If yes, please specify the textbook(s), the number of students by grade level(s) and the year of publication. If you have already included a textbook under a previous category, see Question 1 (pages 4-5) and mark this textbook (GS). This will indicate that the textbook may be specialized and it is used as a general science textbook. If you have not listed the text, please list below.

Science Course	Name of Textbook	Year of Publication	Number of Students by Grade Levels					
			7th	8th	9th	10th	11th	12th
General Science	1. ______________________________							
	2. ______________________________							
	3. ______________________________							
	4. ______________________________							

3. Does your school offer specialized science courses in other areas? (Circle one). Yes No

If yes, please complete the following, indicating textbook(s) used.

Science Course	Name of Textbook	Year of Publication	Number of Students by Grade Levels					
			7th	8th	9th	10th	11th	12th
Astronomy	1.							
	2.							
Physiology	1.							
	2.							
Zoology	1.							
	2.							
Botany	1.							
	2.							
Oceanography	1.							
	2.							
Geology	1.							
	2.							
Advanced Biology (Second Year)	1.							
	2.							
Advanced Chemistry (Second Year)	1.							
	2.							
Advanced Physics (Second Year)	1.							
	2.							
Honors Science Program	1.							
	2.							
Other (Specify)	1.							
	2.							
	3.							
	4.							

4. Is Environmental/Conservation Education taught in your school? (Circle one) . . . . . . Yes No

If yes, please circle grade level to indicate whether Environmental/ Conservation Education is taught as a separate subject or in relation to other subjects.

(Circle grade level where taught)

	Grade	Level				
Taught separately	7	8	9	10	11	12
Taught with science	7	8	9	10	11	12
Taught with social studies.	7	8	9	10	11	12
Integrated with two or more subjects including science.	7	8	9	10	11	12
Integrated with two or more subjects not including science.	7	8	9	10	11	12
Other (Specify)						
________________________________	7	8	9	10	11	12
________________________________	7	8	9	10	11	12

5. Does your school currently offer separate science courses designed for:

a. Below average students (Circle one). . . . . Yes No

b. Gifted students (Circle one) . . . . Yes No

6. Do you feel that your school should offer separate science courses designed for:

a. Below average students (Circle one). . . . . Yes No

b. Gifted students (Circle one) . . . . Yes No

VI. CHANGE

1. Have any major changes been made since 1971 in your school science program? (Circle one) Yes No

If yes, please complete a and b. **If no**, go on to 2.

a. Please check all items below which best describe the major changes in your school science program.

____ Revised courses
____ Added courses
____ Eliminated courses
____ Changed textbooks
____ Developed new materials locally

____ Reduced student course requirements in science
____ Increased student course requirements in science
____ Other (Specify) ________
____
____

b. Please indicate what you believe are the basic reasons for changes that have taken place.

2. How satisfied are you with your current science program? (Please check one)

____ Very Satisfied
____ Satisfied
____ Neutral
____ Dissatisfied
____ Very Dissatisfied

3. If you marked neutral, dissatisfied, very dissatisfied, indicate what you would like to change?

END OF THE PRINCIPAL'S QUESTIONNAIRE

THANK YOU FOR YOUR COOPERATION

SMEAC Information Reference Center
College of Education
The Ohio State University
1200 Chambers Road, Room 310
Columbus, OH 43212

ATTITUDES TOWARD SCIENCE CURRICULUM AND INSTRUCTION

PRINCIPAL QUESTIONNAIRE

Please read over the questionnaire to get an idea of the scope of questions before beginning to fill out the form. Please provide a response for each question. Thank you for your cooperation and assistance.

I. DECISION MAKING

1. How much influence do you feel you have in determining the science curriculum for your building? (Circle your response)

Considerable	Some	None
3	2	1

2. How much influence do you feel each of the following groups or individuals has in determining the science curriculum for your building? (Circle your response)

	Considerable	Some	None
State Department of Education	3	2	1
District Superintendent	3	2	1
Central Staff (Curriculum Coordinator or Supervisor)	3	2	1
School Board	3	2	1
Principal	3	2	1
Department Chairmen	3	2	1
Teachers	3	2	1
Students	3	2	1
Parents	3	2	1
Other (Specify) ____________________			

3. How much influence do you feel you should have in determining the science curriculum in your building? (Circle your response)

Considerable	Some	None
3	2	1

4. How much influence do you feel each of the following groups or individuals should have in determining the science curriculum in your building? (Circle your responses)

	Considerable	Some	None
State Department of Education	3	2	1
District Superintendent	3	2	1
Central Staff (Curriculum Coordinator or Supervisor).	3	2	1
School Board.	3	2	1
Principal	3	2	1
Department Chairman	3	2	1
Teachers.	3	2	1
Students.	3	2	1
Parents	3	2	1
Other (Specify) ____________________			

II. CHANGES IN SCIENCE CURRICULUM AND INSTRUCTION

1. Which of the following conditions best describes your general attitude toward the introduction of new practices and materials in your building? (Circle your response)

Very Positive	Positive	Neutral	Negative	Very Negative
5	4	3	2	1

2. Which of the following conditions do you believe best describes the general attitude of each of the following groups or individuals toward the introduction of new practices and materials in your building? (Circle your response)

	Very Positive	Positive	Neutral	Negative	Very Negative
State Department of Education	5	4	3	2	1
District Superintendent	5	4	3	2	1
Central Staff (Curriculum Coordinator or Supervisor)	5	4	3	2	1
School Board.	5	4	3	2	1
Principal	5	4	3	2	1
Department Chairman	5	4	3	2	1
Teachers.	5	4	3	2	1
Students.	5	4	3	2	1
Parents	5	4	3	2	1
Other (Specify) ____________________					

III. RESOURCES

1. What do you believe should be spent on new science materials and programs compared to current spending? (Circle your response)

	Much More	More	Same	Less	Much Less
From local funds	5	4	3	2	1
From state funds	5	4	3	2	1
From federal funds	5	4	3	2	1

2. In your opinion, how much additional science equipment and supplies are needed in your school? (Circle your response)

Much More	Somewhat More	No More
3	2	1

3. In your opinion, how useful is the information you get about new practices and materials in science education from each of the following? (Circle your response)

A. Person-to-Person Communication Contact With	Very Useful	Useful	Not Useful
1. Your Building			
a. Teachers in your school	3	2	1
2. Your School District (Other than your building)			
a. Teachers outside your school but within your school district	3	2	1
b. Principals outside your school but within your school district	3	2	1
c. Curriculum specialists within your school district	3	2	1
d. Other professionals within your school district	3	2	1
e. Other (Specify) ________________			
3. Outside Your School District			
a. Teachers outside your school district	3	2	1
b. Principals outsife your school district	3	2	1
c. State department personnel	3	2	1
d. Curriculum specialists outside your school district but not from state department	3	2	1
e. Textbook sales representatives	3	2	1
f. College professors	3	2	1
g. Science project and materials developers	3	2	1
h. Other (Specify) ________________			

	Very Useful	Useful	Not Useful
B. Printed Communication			
1. Professional journals and periodicals	3	2	1
2. Textbooks and other books	3	2	1
3. Bulletins and newsletters	3	2	1
4. Other (Specify) ______			
C. Formal Courses and Inservices Education			
1. Formal Courses.			
a. Regular college courses and workshops	3	2	1
b. Special college courses and workshops (designed in cooperation with local or regional groups especially for them)	3	2	1
2. Inservice Programs.			
a. Local district inservice programs (seminars, workshops, etc.)	3	2	1
b. County or intermediate unit inservice programs (seminars, workshops, etc.)	3	2	1
c. State inservice programs (seminars, workshops, etc.)	3	2	1
d. National Science Foundation (NSF) or other federally-sponsored inservice programs (courses, seminars, workshops, etc.)	3	2	1
e. Other (Specify) ______			
D. Mass Media			
1. TV			
a. Public TV (Including Instructional TV)	3	2	1
b. Commercial TV	3	2	1
2. Radio			
a. Public Radio (Including Instructional Radio)	3	2	1
b. Commercial Radio	3	2	1
3. Newspapers	3	2	1
4. General Magazines	3	2	1
5. Other (Specify) ______			
E. Meetings of Professional Organizations			
1. Local professional organizations	3	2	1
2. State professional organizations	3	2	1
3. National professional organizations	3	2	1
4. Other (Specify) ______			

4. Please indicate how useful each of the following types of information about science materials and practices is to you.

	Very Useful	Useful	Not Useful
A. Information about Curriculum	3	2	1
1. National Science Foundation (NSF) sponsored materials	3	2	1
2. State curriculum guides and materials	3	2	1
3. Locally developed curriculum materials	3	2	1
4. Implementation strategies	3	2	1
5. Supplementary activities	3	2	1
6. Philosophy/Rationale underlying curriculum	3	2	1
7. Other (Specify) ______			
B. Information about Instruction	3	2	1
1. Teaching techniques	3	2	1
2. Laboratory techniques	3	2	1
3. Individualized instruction	3	2	1
4. Televised instruction	3	2	1
5. Audiovisual instruction	3	2	1
6. Other (Specify) ______			
C. Information about Classroom Management	3	2	1
1. Students' behavior	3	2	1
2. Classroom management	3	2	1
D. Information about Evaluation Methodology	3	2	1
E. Information about Policies, Standards, and Regulations	3	2	1
F. Information about Budget and Expenditures	3	2	1
G. Information about Court and Judicial Decisions Related to Education	3	2	1
H. Other (Specify) ______ ______			

5. If you request information about science materials and practices from a source such as a publisher, ERIC, state department of education, etc., how soon do you usually need the following types of information? (Circle your response)

	Within 48 Hours	Within a Week	Within One Month	Within Six Months
A. Information about Curriculum	4	3	2	1
1. National Science Foundation (NSF) sponsored materials	4	3	2	1
2. State curriculum guides and materials	4	3	2	1
3. Local developed curriculum materials	4	3	2	1
4. Implementation strategies	4	3	2	1
5. Supplementary activities	4	3	2	1
6. Philosophy/Rationale underlying curriculum	4	3	2	1
7. Other (Specify) ____________				
B. Information about Instruction	4	3	2	1
1. Teaching techniques	4	3	2	1
2. Laboratory techniques	4	3	2	1
3. Individualized instruction	4	3	2	1
4. Televised instruction	4	3	2	1
5. Audiovisual instruction	4	3	2	1
6. Other (Specify) ____________				
C. Information about Classroom Management	4	3	2	1
1. Students' behavior	4	3	2	1
2. Classroom management	4	3	2	1
D. Information about Evaluation Methodology	4	3	2	1
E. Information about Policies, Standards, and Regulations	4	3	2	1
F. Information about Budget and Expenditures	4	3	2	1
G. Information about Court and Judicial Decisions related to Education	4	3	2	1
H. Other (Specify) ____________ ____________				

IV. FEDERAL SUPPORT FOR CURRICULUM DEVELOPMENT:

1. Please indicate your agreement or disagreement with each of the following statements about federal support for science course improvement. (Circle your response)

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
a. Federal support for course improvement and dissemination has improved the quality of curriculum alternatives available to schools	5	4	3	2	1
b. The federal course improvement effort has improved the quality of classroom instruction.	5	4	3	2	1
c. The federal government should direct more attention toward disseminating materials and practices	5	4	2	2	1
d. Federal support of the development of materials and practices is probably unnecessary	5	4	3	2	1
e. Federal support for course improvement and dissemination tends to create a nationally uniform curriculum.	5	4	3	2	1
f. The National Science Foundation (NSF) should sponsor programs to help teachers learn to implement NSF-funded courses and materials.	5	4	3	2	1
g. The National Science Foundation (NSF) should sponsor programs to help teachers learn to implement non-NSF funded courses and materials.	5	4	3	2	1
h. Federal funding should be provided to schools for the purchase of lab equipment and facilities.	5	4	3	2	1

2. In your opinion, what effect has the recent reduction of the National Science Foundation funds for science education had on science curricula? (Circle your response)

Very Positive	Positive	Neutral	Negative	Very Negative	Don't Know
5	4	3	2	1	0

V. SCIENCE PROGRAMS

1. How important are the following for the secondary school science program? (Circle your response)

	Very Important	Important	Not Important
Factual knowledge: Facts, concepts, principles	3	2	1
Processes of science.	3	2	1
Interaction of science and society.	3	2	1
Interaction of science and technology	3	2	1
Values and ethics of science.	3	2	1
Appreciation of human and scientific endeavor	3	2	1
Attitudes toward science.	3	2	1
Interrelationship of science and humanities	3	2	1
Career knowledge and awareness.	3	2	1
Skills.	3	2	1
Nature of science	3	2	1
Relationships of self and environment	3	2	1

VI. BARRIERS TO CHANGE

1. The following factors may have a negative effect on the improvement of practice in your science program. In your opinion, how much of a problem is each of the following? (Circle your response)

	Serious Problem	Somewhat of a Problem	Not a Significant Problem
Lack of inservice opportunities	3	2	1
Lack of adequate consultant services	3	2	1
Inadequate facilities	3	2	1
Lack of science equipment and supplies	3	2	1
Lack of materials for individualized instruction	3	2	1
Insufficient budget	3	2	1
High costs of curriculum materials	3	2	1
Out-of-date teaching materials	3	2	1
No agreement on what should be included in the curriculum	3	2	1
Low priority of science education	3	2	1
Inadequate student reading ability	3	2	1
Inadequate student mathematics background	3	2	1
Low enrollment in science courses	3	2	1
Inadequate articulation of instruction across classrooms within a building	3	2	1
Inadequate articulation of instruction across classrooms across buildings within a district	3	2	1
Teachers inadequately prepared to teach science	3	2	1
Lack of teacher planning time	3	2	1
Lack of interest of teachers	3	2	1
Lack of federal support for curriculum development	3	2	1
Lack of state support for curriculum development	3	2	1
Lack of local support for curriculum development	3	2	1
Lack of administrative support for change	3	2	1
Lack of community support for change	3	2	1
Lack of staff support for change	3	2	1
State regulations and policies	3	2	1
Federal regulations and policies	3	2	1
Lack of communication between principals and teachers	3	2	1
Lack of consultants	3	2	1
Lack of tangible incentives to faculty	3	2	1
Lack of intangible incentives to faculty	3	2	1
Increasing emphasis on basic skills and knowledge	3	2	1
Lack of laboratory assistants	3	2	1
Other (Specify)			

2. Recent research studies have identified a number of tangible incentives. Please select three and only three of the following tangible incentives which you feel would encourage principals to try ideas for the improvement of practice. Mark the most important "3," the second most important "2," and the third most important "1."

_____ Extra pay for special activities
_____ Salary differential
_____ College credit
_____ Released time

_____ Travel funds
_____ Participating in workshops and in-service training courses
_____ Promotion
_____ Other (specify) ______________________________
____

3. Recent research studies have identified a number of intangible incentives. Which of these intangible incentives do you feel would be most important for encouraging principals to try ideas for the improvement. Select the three highest. Mark the most important "3," the second most important "2," and third most important "1."

_____ Recognition and prestige of excellence
_____ Opportunity to pursue beliefs and ideals
_____ Opportunity to pursue new ideas
_____ Desire to know and understand

_____ Desire to escape from boredom and routine
_____ Professional interest or commitment
_____ Intrinsic satisfaction derived from doing better jobs
_____ Opportunity for the development of strong and lasting group affiliation based on shared purposes
_____ Increase sense of influence over educational outcomes
_____ A possible solution to perceived student needs
_____ Other (specify) ______________________________
____

4. Which type of science curricula do you prefer in your school? Please check one.

_____ a. A textbook; use with very little modification.
_____ b. A textbook; use parts and supplement with other materials.
_____ c. Several textbooks; use each when it is most appropriate for the students.
_____ d. Teacher developed materials for a local program.
_____ e. Other (specify) ______________________________
____

END OF THE PRINCIPAL'S QUESTIONNAIRE

THANK YOU FOR YOUR COOPERATION

SMEAC Information Reference Center
College of Education
The Ohio State University
1200 Chambers Road, Room 310
Columbus, OH 43212

*CHECKLIST FOR ASSESSMENT OF SCIENCE TEACHERS:
PRINCIPAL'S PERCEPTION
(CAST: PP)

The purpose of this checklist is to determine the types of activities which you feel usually take place or should take place in your science classrooms. Please select the response for each item that BEST describes what usually does take place AND what you believe should take place in your science classrooms.

Respond as you believe your teachers will respond for what does take place; respond as you believe what should take place. Use the answer sheet provided.

Example

How often are hands-on materials used in your science classrooms?

(a) Once a week
(b) Twice a week
(c) Three times a week
(d) Four times a week
(e) Five times a week

Answer

Does Take Place a b [✓ c] d e

Should Take Place a b c d [✓ e]

---

*This instrument is adopted from the work of Robert W. Howe, William R. and Betty J. Brown, 283 Arps Hall, The Ohio State University, November 1970, edition.

1. What do the students do in your class?

   a. The students often discuss the problems faced by scientists in the discovery of a scientific principle. They also discuss the kind of evidence that is behind a scientist's conclusions. If the students do not agree with me, I encourage them to say so. The students are frequently given time in class to talk among themselves about ideas in science. They usually do most of the experiments and demonstrations themselves.

   b. The students sometimes discuss the problems faced by scientists in the discovery of a scientific principle. They also discuss the evidence that is behind a scientist's conclusions. They sometimes do experiments and demonstrations themselves. They can question what I say.

   c. The students infrequently discuss the problems faced by scientists in the discovery of a scientific principle. They spend part of the class time answering my questions. They also write answers to questions from their textbook or study guides. They do some experiments themselves.

   d. The students ask questions to clarify what I, or the textbook, have told them. They watch me do demonstrations. They write answers to questions from the textbook or study guides. They answer my questions.

   e. The students must copy down and memorize what I tell them. Most of the students' questions are to clear up what I or the textbook has told th[illegible] They often write answers to questions from the textbook o[illegible]y guides.

2. What is your role in your classroom?

   a. I help the students understand the general objectives or purposes of a lesson before they begin work on the lesson. I question the students about ideas that the students have studied previously and about the evidence that is behind statements that are made in the textbook. I often ask the students to explain diagrams and graphs.

   b. I often question the students about ideas that they have studied previously and about the evidence that is behind statements that are made in the textbook. I sometimes ask the students to explain diagrams and graphs.

   c. I spend most of the classtime telling the students about science. I repeat much of what the textbook says. I sometimes question the students about ideas that they have studied.

   d. I sometimes repeat exactly what the textbook says. If there is a disagreement among students during a discussion, I usually tell the students who is right. Most of the time I tell the students about science.

   e. I show the students that science has almost all of the answers to questions about the natural world. If there is a disagreement among students during a discussion, I tell the students who is right. I often repeat exactly what the textbook says.

3. How do you use the textbook and reference materials?

   a. I expect the students to find the major ideas in the textbook and the evidence to support the ideas. I show the students how to question ideas in the textbook. I provide time for the students to read about science in magazines and books other than the textbook.

   b. I expect the students to learn some of the details in the textbook. There are books and magazines in the room if the students want to use them. I show the students how to question ideas in the textbook.

   c. I expect the students to learn many of the details in the textbook. I have the students look for some of the major ideas in the textbook and the evidence to support the ideas. I sometimes require students to outline parts of the textbook. The only science talked about is from the textbook and my notes.

   d. I expect the students to outline part of the textbook. The only science talked about is from the textbook and my notes. I require the students to learn most of the details in the textbook.

   e. I do not like the students to question information in the textbook. I often have the students write out definitions to words. I require the students to outline parts of the textbook and to memorize most of the details in the textbook.

4. How are your tests designed and how are they used?

   a. My tests have many questions about the laboratory activities. The tests often require the students to figure out answers to new problems. Sometimes the students must find ways of looking for answers to problems. Often they must repeat skills they have learned in the laboratory, such as making observations and interpreting data.

   b. My tests have many questions about the laboratory activities. The tests sometimes require the students to figure out answers to new problems. Sometimes the students must repeat skills they have learned in the laboratory, such as making observations and interpreting data.

   c. My tests sometimes ask the students to label drawings. The tests sometimes have questions about the laboratory activities. Sometimes the tests require the students to tell about ideas that they have learned previously.

   d. My tests often ask the students to write out definitions to words. The tests do not require the use of mathematics to answer the questions. Often the tests require the students to label drawings.

   e. My tests often require the students to write out definitions to words. Often the students must label drawings. The tests do not require the use of mathematics to answer the questions. I do not discuss the test questions in class.

5. How do you conduct your laboratory?

   a. My students and I spend time before an experiment discussing the purposes of the experiment. I often allow the students to try their own ways of doing the laboratory experiment. The students can compare their answers to those of others when they are finished. They are allowed to do the experiments on their own.

   b. My students and I spend time before most experiments discussing the purposes of the experiment. The data one student gathers from an experiment are often different from the data gathered by another student. I allow the students to do some experimenting on their own.

   c. My students and I sometimes discuss the purposes of an experiment. The students sometimes may compare their answers to those of others when they are finished. I allow less than one-third of classtime for laboratory experiments.

   d. I sometimes conduct the laboratory in such a way that the students know the answers to a question before they do an experiment. My students and I seldom discuss the purposes of an experiment. I allow less than one-fourth of the classtime for laboratory experiments.

   e. I do not allow students to do experiments on their own. I conduct the laboratory in such a way that the students know the answers to a question before they do the experiment. I do not discuss the purpose of an experiment. I allow very little classtime for laboratory experiments.

END OF QUESTIONNAIRE

CAST: PP

ANSWER SHEET

Name of School ______________________________

Please CIRCLE the response that BEST fits your answer.

1.	Does Take Place	a	b	c	d	e
	Should Take Place	a	b	c	d	e
2.	Does Take Place	a	b	c	d	e
	Should Take Place	a	b	c	d	e
3.	Does Take Place	a	b	c	d	e
	Should Take Place	a	b	c	d	e
4.	Does Take Place	a	b	c	d	e
	Should Take Place	a	b	c	d	e
5.	Does Take Place	a	b	c	d	e
	Should Take Place	a	b	c	d	e

THANK YOU FOR YOUR COOPERATION

Please Return Answer Sheet To:

Hussein Bashir Mahmoud, Graduate Research Associate
SMEAC Information Reference Center
1200 Chambers Road, Room 310
Columbus, OH 43212
Phone: (614) 422-6717

SMEAC Information Reference Center
College of Education
The Ohio State University
1200 Chambers Road, Room 310
Columbus, OH 43212

STATUS OF SCIENCE TEACHING IN PUBLIC SECONDARY SCHOOLS

Selected Sample for 1979-80

SCIENCE TEACHER QUESTIONNAIRE

Name of School: ______________________________

Address of School: ______________________________

Number ______ Street ______

City ______ County ______

State ______ Zip Code ______

General Instructions:

The purpose of this questionnaire is to provide current information about your school and the science courses and projects you teach in 1979-80.

This questionnaire is to be answered for the individual secondary school science teacher. Please check over the questionnaire before beginning to fill out the form. Chuck (✓) or complete all items that apply.

Definition:

For purposes of this study, a secondary school science teacher is defined as "a teacher who teaches at least one science course or subject in any grade level or combination of grade levels from 7 through 12, in any school designated as a public secondary school."

I. TEACHER CHARACTERISTICS

Check (✓) or fill in the blanks

1. Age
   - ____ 20-29
   - ____ 30-39
   - ____ 40-49
   - ____ 50-59
   - ____ 60-69

2. Sex ____ Male ____ Female

3. Please check the degree(s) you now hold, and specify the major and minor subject matter fields of the degree(s).

Degree(s) Held	Subject Matter Fields	
____ B.S. or B.A.	Major ______	Minor(s) ______
____ M.S. or M.A.	Major ______	Minor(s) ______
____ Ph.D. or Ed.D.	Major ______	Minor(s) ______
____ Other (specify) ______	Major ______	Minor(s) ______

4. Have you attended any NSF-sponsored inservice activities? (Circle one) . . . . Yes No

If yes, please check the kind of NSF-sponsored activities you have attended.

Prior to 1974

a. ___ Academic Year Institutes
b. ___ Administrators Conferences
c. ___ Cooperative College-School Science Program
d. ___ Inservice Institutes
e. ___ Resource Personnel Workshops
f. ___ Summer Institutes
g. ___ Other (specify)____________

After 1974

a. ___ Chautauqua Short Courses
b. ___ Leadership Development Projects
c. ___ School System Projects
d. ___ Teacher Centered Projects
e. ___ Other (specify)____________

II. TEACHING LOAD

Please list below all subjects or courses you are teaching, and fill in the related information

Example:

A teacher who teaches two sections of 10th grade BSCS Biology-Blue Version with 20 students in one section and 28 students in the other section would fill in the information as follows:

BSCS Blue Version ______ 10 ___ 2 ___ 24

Subject/Course	Grade Level(s)	No. of Sections or Classes	Average Class Size

III. SPECIAL SCIENCE FACILITIES

1. Please indicate the facilities available and how much you use them in teaching science in your school.

Special Science Facility	Availability (Circle one)	Usage (Circle one): Often (At least once a week)	Occasionally (Once or twice a month)	Rarely (Less than once a month)
a. Auto-tutorial laboratory	Yes . . No	Oft	Occ	R
b. Closed-circuit television	Yes . . No	Oft	Occ	R
c. Broadcast television	Yes . . No	Oft	Occ	R
d. Videotape recorder/player	Yes . . No	Oft	Occ	R
e. Ham radio station	Yes . . No	Oft	Occ	R
f. Greenhouse	Yes . . No	Oft	Occ	R
g. Land laboratory	Yes . . No	Oft	Occ	R
h. Nature trail(s)	Yes . . No	Oft	Occ	R
i. Observatory	Yes . . No	Oft	Occ	R
j. Planetarium	Yes . . No	Oft	Occ	R
k. Science darkroom	Yes . . No	Oft	Occ	R
l. Ventilated animal house	Yes . . No	Oft	Occ	R
m. Computer or Computer Terminals	Yes . . No	Oft	Occ	R
n. Weather station	Yes . . No	Oft	Occ	R
o. Other (specify) ________________ ________________				

2. Please check the kind of room that you use to conduct your science classes.

____ Laboratory or special room
____ Classroom with no science facilities or kits
____ Classroom with portable science kits
____ Other (specify) ____________ ____________________

IV. SCIENCE TEACHING

1. Please specify the kind of curriculum materials and/or textbooks that you use for your science classes. Check as many as applicable.

a. ____ Single textbook
b. ____ Single textbook including laboratory manual
c. ____ Multiple textbooks including laboratory manual(s)
d. ____ Separate laboratory manual
e. ____ Multiple textbooks
f. ____ Locally-prepared materials
g. ____ Other (specify) __________ ____________________

1. Please specify the number of your students by grade level(s) who are taking the following science courses during the 1979-80 school year. If a textbook is used as a major teaching tool in your classes, please specify the number of students by grade level(s) using that text and the year of publication. If a particular course or textbook is not in use, leave the corresponding space blank.

Science Course	Textbook or Course	Year of Publication	Number of Students by Grade Levels					
			7th	8th	9th	10th	11th	12th
Biology or Life Science	1. Biological Science: An Ecological Approach (BSCS Green).							
	2. Biological Science: An Inquiry into Life (BSCS Yellow) .							
	3. Biological Science: Interaction of Experiments and Ideas (BSCS).							
	4. Biological Science: Me and My Environment							
	5. Biological Science: Molecules to Man (BSCS Blue). . . .							
	6. Biological Science: Patterns and Processes (BSCS) . . .							
	7. Biology: Introduction to Life (Nason)							
	8. Biology: Living Systems (Oram)							
	9. Biology (Kroeber)							
	10. Biology (Smallwood).							
	11. Focus on Life Science (Heimler).							
	12. Human Sciences Program (BSCS).							
	13. Interaction of Man and the Biosphere: Inquiry in Life Science (Abraham)							
	14. Life in the Environment (Navarra).							
	15. Life: Its Forms and Changes							
	16. Living Things (Fitzpatrick)							
	17. Modern Biology (Otto)							
	18. Other Biology or Life Science Text or Course (Specify) ____________________							
	____________________							
Chemistry	1. Chemistry: An Experimental Science (Primental).							
	2. Chemistry: An Investigative Approach (Cotton)							
	3. Chemistry: Experiments and Principles (CHEM Study). . .							
	4. Chemistry (Sienko).							
	5. Interdisciplinary Approach to Chemistry (IAC).							
	6. Modern Chemistry (Metcalfe)							
	7. Other Chemistry Text or Course (Specify) ____________________							
	____________________							

Question 1 continues next page.

Science Course	Textbook or Course	Year of Publication	Number of Students by Grade Levels					
			7th	8th	9th	10th	11th	12th
Physics	1. College Physics (Schaum)							
	2. Modern Physics (Williams)							
	3. PSSC Physics (Haber-Schaim)							
	4. The Project Physics (Rutherford)							
	5. Other Physics Text or Course (Specify) ____________________							
	____________________							
Physical Science	1. Interaction of Matter and Energy: Inquiry in Physical Science (Abraham)							
	2. Introductory Physical Science (IPS)(Haber-Schaim)							
	3. Modern Physical Science (Tracy)							
	4. Physical Science II (PS II) (Haber-Schaim)							
	5. The Man Made World (ECCP)							
	6. Other Physical Science Text or Course (Specify) ____________________							
	____________________							
Earth Science	1. Earth Science: The World We Live In (Namowitz)							
	2. Focus on Earth Science (Bishop)							
	3. Investigating the Earth (ESCP)							
	4. Modern Earth Science (Ramsey)							
	5. Time, Space and Matter (TSM)							
	6. Other Earth Science Text or Course (Specify) ____________________							
	____________________							
Other Courses or Text-books	1. Individualized Science Instructional System (ISIS) (Burkman)							
	2. Modern Science Series (Blanc)							
	3. Principles of Science Series (Heimler)							
	4. Probing the Natural World (ISCS)							
	5. Study Lessons in General Science (Cross)							
	6. Other Texts or Courses (Specify) ____________________							
	____________________							

3. Do you teach a general science course? (Circle one) . . . . Yes No

If yes, please specify the textbook(s), the number of students by grade level(s) and the year of publication. If you have already included a textbook under a previous category, see Question 2 (pages 4-5) and mark this textbook (GS). This will indicate that the textbook may be specialized and it is used as a general science textbook. If you have not listed the text, please list below.

Science Course	Name of Textbook	Year of Publication	Number of Students by Grade Levels					
			7th	8th	9th	10th	11th	12th
General Science	1. ____________________							
	2. ____________________							
	3. ____________________							
	4. ____________________							

4. Do you teach specialized science courses in other areas? (Circle one) . . . . Yes No

If yes, please complete the following, indicating textbook(s) used.

Science Course	Name of Textbook	Year of Publication	Number of Students by Grade Levels					
			7th	8th	9th	10th	11th	12th
Astronomy	1. ______							
	2. ______							
Physiology	1. ______							
	2. ______							
Zoology	1. ______							
	2. ______							
Botany	1. ______							
	2. ______							
Oceanography	1. ______							
	2. ______							
Geology	1. ______							
	2. ______							
Advanced Biology (Second Year)	1. ______							
	2. ______							
Advanced Chemistry (Second Year)	1. ______							
	2. ______							
Advanced Physics (Second Year)	1. ______							
	2. ______							
Honors Science Program	1. ______							
	2. ______							
Other (Specify)	1. ______							
	2. ______							
	3. ______							
	4. ______							

5. Do you currently teach separate science courses designed for:

   a. Below average students (Circle one). . . . . Yes No

   b. Gifted students (Circle one) . . . . Yes No

6. Do you feel that your school should offer separate science courses designed for:

   a. Below average students (Circle one). . . . . Yes No

   b. Gifted students (Circle one) . . . . Yes No

7. Do you feel that you need assistance in any of the following areas? (Circle one on each item)

   a. Obtaining information about recent curriculum developments. . . . . Yes No

   b. Obtaining information about new teaching methods. . . . Yes No

   c. Obtaining information about instructional materials . . . . Yes No

   d. Obtaining information about subject matter. . . . . . Yes No

   e. Obtaining information about out-of-school resources . . . . Yes No

   f. Obtaining information about films, TV and radio programs. Yes No

   g. Implementing new curriculum projects. . . . . Yes No

   h. Developing local curriculum materials . . . . Yes No

   i. Implementing discovery/inquiry approach . . . . Yes No

   j. Articulating instruction across classrooms within a building and across different buildings . . . . Yes No

   k. Using manipulative or hands-on materials . . . . . . Yes No

   l. Developing skills to use new science equipment and facilities . . . . Yes No

   m. Developing skills to use audiovisual aids . . . . . . Yes No

   n. Other (specify)____

   ____

8. Do you feel that you need more inservice training opportunities? (Circle one) . . . . Yes No

   If yes, please indicate the type of inservice opportunities. Check as many as applicable.

   ____ Inservice opportunities in science content
   ____ Inservice opportunities in change strategies
   ____ Inservice opportunities in evaluation strategies
   ____ Inservice opportunities in science teaching techniques
   ____ Other (specify)____

   ____

V. LEARNING ACTIVITIES

Please indicate the three learning activities that you use most often. Use "3" for the activity used most often, "2" for the next most often, and "1" for the third most often used activity.

____ Group laboratory activity
____ Individual laboratory activity
____ Science demonstration
____ Auto-tutorial instruction

____ Programmed instruction
____ Televised instruction
____ Instructional films/filmstrips
____ Excursions or field studies

____ Lecture
____ Lecture-Discussion
____ Small group discussion
____ Independent studies

____ Library work
____ In-class written assignments
____ Guest speakers
____ Others (specify)____________
____
____

VI. CHANGE

1. Were you teaching during the 1970-71 school year at this school? (Circle one) . . . . Yes No

If yes, please go to a. If no, go on to 2.

a. Have any major changes been made since 1971 in your classroom science? (Circle one) . . . . . Yes No

If yes, please complete b and c.

b. Please check all items below which best describe the major changes in your classroom science.

____ Revised courses
____ Added courses
____ Eliminated courses
____ Changed textbooks
____ Developed new materials locally

____ Reduced student course requirements in science
____ Increased student course requirements in science
____ Other (specify)__________
____
____

c. Please indicate what you believe are the basic reasons for changes that have taken place?

____
____
____
____
____
____
____
____
____

2. How satisfied are you with your current science program? (Please check one)

____ Very Satisfied
____ Satisfied
____ Neutral
____ Dissatisfied
____ Very Dissatisfied

3. If you marked neutral, dissatisfied, very dissatisfied, indicate what you would like to change.

END OF THE TEACHER'S QUESTIONNAIRE

THANK YOU FOR YOUR COOPERATION

SMEAC Information Reference Center
College of Education
The Ohio State University
1200 Chambers Road, Room 310
Columbus, OH 43212

ATTITUDES TOWARD SCIENCE CURRICULUM AND INSTRUCTION

SCIENCE TEACHER QUESTIONNAIRE

Please read over the questionnaire to get an idea of the scope of questions before beginning to fill out the form. Please provide a response for each question. Thank you for your cooperation and assistance.

I. DECISION MAKING

1. How much influence do you feel you have in determining the science curriculum for your building? (Circle your response)

Considerable	Some	None
3	2	1

2. How much influence do you feel each of the following groups or individuals has in determining the science curriculum for your building? (Circle your response)

	Considerable	Some	None
State Department of Education	3	2	1
District Superintendent	3	2	1
Central Staff (Curriculum Coordinator or Supervisor)	3	2	1
School Board	3	2	1
Principal	3	2	1
Department Chairman	3	2	1
Teachers	3	2	1
Students	3	2	1
Parents	3	2	1
Other (Specify) ______________________			

3. How much influence do you feel you should have in determining the science curriculum in your building? (Circle your response)

Considerable	Some	None
3	2	1

4. How much influence do you feel each of the following groups or individuals should have in determining the science curriculum in your building? (Circle your responses)

	Considerable	Some	None
State Department of Education	3	2	1
District Superintendent	3	2	1
Central Staff (Curriculum Coordinator or Supervisor)	3	2	1
School Board	3	2	1
Principal	3	2	1
Department Chairmen	3	2	1
Teachers	3	2	1
Students	3	2	1
Parents	3	2	1
Other (Specify) ______________________			

II. CHANGES IN SCIENCE CURRICULUM AND INSTRUCTION

1. Which of the following conditions best describes your general attitude toward the introduction of new practices and materials in your building? (Circle your response)

Very Positive	Positive	Neutral	Negative	Very Negative
5	4	3	2	1

2. Which of the following conditions do you believe best describes the general attitude of each of the following groups or individuals toward the introduction of new practices and materials in your building? (Circle your response)

	Very Positive	Positive	Neutral	Negative	Very Negative
State Department of Education	5	4	3	2	1
District Superintendent	5	4	3	2	1
Central Staff (Curriculum Coordinator or Supervisor)	5	4	3	2	1
School Board	5	4	3	2	1
Principal	5	4	3	2	1
Department Chairmen	5	4	3	2	1
Teachers	5	4	3	2	1
Students	5	4	3	2	1
Parents	5	4	3	2	1
Other (Specify) ______________________					

III. RESOURCES

1. What do you believe should be spent on new science materials and programs compared to current spending? (Circle your response)

	Much More	More	Same	Less	Much Less
From local funds.	5	4	3	2	1
From state funds.	5	4	3	2	1
From federal funds.	5	4	3	2	1

2. In your opinion, how much additional science equipment and supplies are needed in your school? (Circle your response)

Much More	Somewhat More	No More
3	2	1

3. In your opinion, how useful is the information you get about new practices and materials in science education from each of the following? (Circle your response)

	Very Useful	Useful	Not Useful
A. Person-to-Person Communication Contact With			
1. Your Building			
a. Teachers in your school.	3	2	1
b. Principal in your school	3	2	1
2. Your School District (Other than your building)			
a. Teachers outside your school but within your school district	3	2	1
b. Principals outside your school but within your school district	3	2	1
c. Curriculum specialists within your school district	3	2	1
d. Other professionals within your school district.	3	2	1
e. Other (Specify) ______________________			
3. Outside Your School District			
a. Teachers outside your school district.	3	2	1
b. Principals outside your school district.	3	2	1
c. State department personnel	3	2	1
d. Curriculum specialists outside your school district but not from state department	3	2	1
e. Textbook sales representatives	3	2	1
f. College professors	3	2	1
g. Science project and materials developers	3	2	1
h. Other (Specify) ______________________			

	Very Useful	Useful	Not Useful
B. Printed Communication			
1. Professional journals and periodicals	3	2	1
2. Textbooks and other books	3	2	1
3. Bulletins and newsletters	3	2	1
4. Other (Specify) ______			
C. Formal Courses and Inservices Education			
1. Formal Courses.			
a. Regular college courses and workshops	3	2	1
b. Special college courses and workshops (designed in cooperation with local or regional groups especially for them)	3	2	1
2. Inservice Programs.			
a. Local district inservice programs (seminars, workshops, etc.)	3	2	1
b. County or intermediate unit inservice programs (seminars, workshops, etc.)	3	2	1
c. State inservice programs (seminars, workshops, etc.)	3	2	1
d. National Science Foundation (NSF) or other federally-sponsored inservice programs (courses, seminars, workshops, etc.)	3	2	1
e. Other (Specify) ______			
D. Mass Media			
1. TV			
a. Public TV (Including Instructional TV)	3	2	1
b. Commercial TV	3	2	1
2. Radio			
a. Public Radio (Including Instructional Radio)	3	2	1
b. Commercial Radio	3	2	1
3. Newspapers	3	2	1
4. General Magazines	3	2	1
5. Other (Specify) ______			
E. Meetings of Professional Organizations			
1. Local professional organizations	3	2	1
2. State professional organizations	3	2	1
3. National professional organizations	3	2	1
4. Other (Specify) ______			

4. Please indicate how useful each of the following types of information about science materials and practices is to you.

	Very Useful	Useful	Not Useful
A. Information about Curriculum	3	2	1
1. National Science Foundation (NSF) sponsored materials	3	2	1
2. State curriculum guides and materials	3	2	1
3. Locally developed curriculum materials	3	2	1
4. Implementation strategies	3	2	1
5. Supplementary activities	3	2	1
6. Philosophy/Rationale underlying curriculum	3	2	1
7. Other (Specify) ____________________			
B. Information about Instruction	3	2	1
1. Teaching techniques	3	2	1
2. Laboratory techniques	3	2	1
3. Individualized instruction	3	2	1
4. Televised instruction	3	2	1
5. Audiovisual instruction	3	2	1
6. Other (Specify) ____________________			
C. Information about Classroom Management	3	2	1
1. Students' behavior	3	2	1
2. Classroom management	3	2	1
D. Information about Evaluation Methodology	3	2	1
E. Information about Policies, Standards, and Regulations	3	2	1
F. Information about Budget and Expenditures	3	2	1
G. Information about Court and Judicial Decisions Related to Education	3	2	1
H. Other (Specify) ____________________ ____________________			

5. If you request information about science materials and practices from a source such as a publisher, ERIC, state department of education, etc., how soon do you usually need the following types of information? (Circle your response)

	Within 48 Hours	Within a Week	Within One Month	Within Six Months
A. Information about Curriculum	4	3	2	1
1. National Science Foundation (NSF) sponsored materials	4	3	2	1
2. State curriculum guides and materials	4	3	2	1
3. Local developed curriculum materials	4	3	2	1
4. Implementation strategies	4	3	2	1
5. Supplementary activities	4	3	2	1
6. Philosophy/Rationale underlying curriculum	4	3	2	1
7. Other (Specify) ______				
B. Information about Instruction	4	3	2	1
1. Teaching techniques	4	3	2	1
2. Laboratory techniques	4	3	2	1
3. Individualized instruction	4	3	2	1
4. Televised instruction	4	3	2	1
5. Audiovisual instruction	4	3	2	1
6. Other (Specify) ______				
C. Information about Classroom Management	4	3	2	1
1. Students' behavior	4	3	2	1
2. Classroom management	4	3	2	1
D. Information about Evaluation Methodology	4	3	2	1
E. Information about Policies, Standards, and Regulations	4	3	2	1
F. Information about Budget and Expenditures	4	3	2	1
G. Information about Court and Judicial Decisions related to Education	4	3	2	1
H. Other (Specify) ______ ______				

IV. FEDERAL SUPPORT FOR CURRICULUM DEVELOPMENT:

1. Please indicate your agreement or disagreement with each of the following statements about federal support for science course improvement. (Circle your response)

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
a. Federal support for course improvement and dissemination has improved the quality of curriculum alternatives available to schools	5	4	3	2	1
b. The federal course improvement effort has improved the quality of classroom instruction.	5	4	3	2	1
c. The federal government should direct more attention toward disseminating materials and practices	5	4	3	2	1
d. Federal support of the development of materials and practices is probably unnecessary	5	4	3	2	1
e. Federal support for course improvement and dissemination tends to create a nationally uniform curriculum.	5	4	3	2	1
f. The National Science Foundation (NSF) should sponsor programs to help teachers learn to implement NSF-funded courses and materials.	5	4	3	2	1
g. The National Science Foundation (NSF) should sponsor programs to help teachers learn to implement non-NSF funded courses and materials.	5	4	3	2	1
h. Federal funding should be provided to schools for the purchase of lab equipment and facilities.	5	4	3	2	1

2. In your opinion, what effect has the recent reduction of the National Science Foundation funds for science education had on science curricula? (Circle your response)

Very Positive	Positive	Neutral	Negative	Very Negative	Don't Know
5	4	3	2	1	0

V. SCIENCE PROGRAMS

1. How important are the following for the secondary school science program? (Circle your response)

	Very Important	Important	Not Important
Factual knowledge: Facts, concepts, principles	3	2	1
Processes of science.	3	2	1
Interaction of science and society.	3	2	1
Interaction of science and technology	3	2	1
Values and ethics of science.	3	2	1
Appreciation of human and scientific endeavor	3	2	1
Attitudes toward science.	3	2	1
Interrelationship of science and humanities	3	2	1
Career knowledge and awareness.	3	2	1
Skills.	3	2	1
Nature of science	3	2	1
Relationships of self and environment	3	2	1

VI. BARRIERS TO CHANGE

1. The following factors may have a negative effect on the improvement of practice in your science program. In your opinion, how much of a problem is each of the following? (Circle your response)

	Serious Problem	Somewhat of a Problem	Not a Significant Problem
Lack of inservice opportunities	3	2	1
Lack of adequate consultant services	3	2	1
Inadequate facilities	3	2	1
Lack of science equipment and supplies	3	2	1
Lack of materials for individualized instruction	3	2	1
Insufficient budget	3	2	1
High costs of curriculum materials	3	2	1
Out-of-date teaching materials	3	2	1
No agreement on what should be included in the curriculum	3	2	1
Low priority of science education	3	2	1
Inadequate student reading ability	3	2	1
Inadequate student mathematics background	3	2	1
Low enrollment in science courses	3	2	1
Inadequate articulation of instruction across classrooms within a building	3	2	1
Inadequate articulation of instruction across classrooms across buildings within a district	3	2	1
Teachers inadequately prepared to teach science	3	2	1
Lack of teacher planning time	3	2	1
Lack of interest of teachers	3	2	1
Lack of federal support for curriculum development	3	2	1
Lack of state support for curriculum development	3	2	1
Lack of local support for curriculum development	3	2	1
Lack of administrative support for change	3	2	1
Lack of community support for change	3	2	1
Lack of staff support for change	3	2	1
State regulations and policies	3	2	1
Federal regulations and policies	3	2	1
Lack of communication between principals and teachers	3	2	1
Lack of consultants	3	2	1
Lack of tangible incentives to faculty	3	2	1
Lack of intangible incentives to faculty	3	2	1
Increasing emphasis on basic skills and knowledge	3	2	1
Lack of laboratory assistants	3	2	1
Other (Specify)			
____________________			
____________________			

2. Recent research studies have identified a number of tangible incentives. Please select three and only three of the following tangible incentives which you feel would encourage teachers to try ideas for the improvement of practice. Mark the most important "3," the second most important "2," and the third most important "1."

____ Extra pay for special activities
____ Salary differential
____ College credit
____ Released time

____ Travel funds
____ Participating in workshops and in-service training courses
____ Promotion
____ Other (specify) ______________________________
____

3. Recent research studies have identified a number of intangible incentives. Which of those intangible incentives do you feel would be most important for encouraging teachers to try ideas for the improvement. Select the three highest. Mark the most important "3," the second most important "2," and third most important "1."

____ Recognition and prestige of excellence
____ Opportunity to pursue beliefs and ideals
____ Opportunity to pursue new ideas
____ Desire to know and understand

____ Desire to escape from boredom and routine
____ Professional interest or commitment
____ Intrinsic satisfaction derived from doing better teaching
____ Opportunity for the development of strong and lasting group affiliation based on shared purposes
____ Increase sense of influence over educational outcomes
____ A possible solution to perceived student needs
____ Other (specify) ______________________________
____

4. Which type of science curricula do you prefer in your school? Please check one.

____ a. A textbook; use with very little modification.
____ b. A textbook; use parts and supplement with other materials.
____ c. Several textbooks; use each when it is most appropriate for the students.
____ d. Teacher developed materials for a local program.
____ e. Other (specify) ______________________________
____

END OF THE TEACHER'S QUESTIONNAIRE

THANK YOU FOR YOUR COOPERATION

SMEAC Information Reference Center
College of Education
The Ohio State University
1200 Chambers Road, Room 310
Columbus, OH 43212

*CHECKLIST FOR ASSESSMENT OF SCIENCE TEACHERS: TEACHER'S PERCEPTION
(CAST: TP)

The purpose of this checklist is to determine the types of activities which you feel usually take place or should take place in your science classroom. Please select the response for each item that BEST describes what usually does take place AND what you believe should take place in YOUR SCIENCE CLASSROOM. Use the answer sheet provided.

Example

How often are hands-on materials used in your science classrooms?

(a) Once a week
(b) Twice a week
(c) Three times a week
(d) Four times a week
(e) Five times a week

Answer

Does Take Place a b [✓ c] d e
Should Take Place a b c d [✓ e]

---

*This instrument is adopted from the work of Robert W. Rowe; William R. and Betty J. Brown, 283 Arps Hall, The Ohio State University, November 1970, edition.

1. What do the students do in your class?

   a. The students often discuss the problems faced by scientists in the discovery of a scientific principle. They also discuss the kind of evidence that is behind a scientist's conclusions. If the students do not agree with me, I encourage them to say so. The students are frequently given time in class to talk among themselves about ideas in science. They usually do most of the experiments and demonstrations themselves.

   b. The students sometimes discuss the problems faced by scientists in the discovery of a scientific principle. They also discuss the evidence that is behind a scientist's conclusions. They sometimes do experiments and demonstrations themselves. They can question what I say.

   c. The students infrequently discuss the problems faced by scientists in the discovery of a scientific principle. They spend part of the class time answering my questions. They also write answers to questions from their textbook or study guides. They do some experiments themselves.

   d. The students ask questions to clarify what I, or the textbook, have told them. They watch me do demonstrations. They write answers to questions from the textbook or study guides. They answer my questions.

   e. The students must copy down and memorize what I tell them. Most of the students' questions are to clear up what I or the textbook has told them. They often write answers to questions from the textbook or study guides.

2. What is your role in your classroom?

   a. I help the students understand the general objectives or purposes of a lesson before they begin work on the lesson. I question the students about ideas that the students have studied previously and about the evidence that is behind statements that are made in the textbook. I often ask the students to explain diagrams and graphs.

   b. I often question the students about ideas that they have studied previously and about the evidence that is behind statements that are made in the textbook. I sometimes ask the students to explain diagrams and graphs.

   c. I spend most of the classtime telling the students about science. I repeat much of what the textbook says. I sometimes question the students about ideas that they have studied.

   d. I sometimes repeat exactly what the textbook says. If there is a disagreement among students during a discussion, I usually tell the students who is right. Most of the time I tell the students about science.

   e. I show the students that science has almost all of the answers to questions about the natural world. If there is a disagreement among students during a discussion, I tell the students who is right. I often repeat exactly what the textbook says.

3. How do you use the textbook and reference materials?

   a. I expect the students to find the major ideas in the textbook and the evidence to support the ideas. I show the students how to question ideas in the textbook. I provide time for the students to read about science in magazines and books other than the textbook.

   b. I expect the students to learn some of the details in the textbook. There are books and magazines in the room if the students want to use them. I show the students how to question ideas in the textbook.

   c. I expect the students to learn many of the details in the textbook. I have the students look for some of the major ideas in the textbook and the evidence to support the ideas. I sometimes require students to outline parts of the textbook. The only science talked about is from the textbook and my notes.

   d. I expect the students to outline part of the textbook. The only science talked about is from the textbook and my notes. I require the students to learn most of the details in the textbook.

   e. I do not like the students to question information in the textbook. I often have the students write out definitions to words. I require the students to outline parts of the textbook and to memorize most of the details in the textbook.

4. How are your tests designed and how are they used?

   a. My tests have many questions about the laboratory activities. The tests often require the students to figure out answers to new problems. Sometimes the students must find ways of looking for answers to problems. Often they must repeat skills they have learned in the laboratory, such as making observations and interpreting data.

   b. My tests have many questions about the laboratory activities. The tests sometimes require the students to figure out answers to new problems. Sometimes the students must repeat skills they have learned in the laboratory, such as making observations and interpreting data.

   c. My tests sometimes ask the students to label drawings. The tests sometimes have questions about the laboratory activities. Sometimes the tests require the students to tell about ideas that they have learned previously.

   d. My tests often ask the students to write out definitions to words. The tests do not require the use of mathematics to answer the questions. Often the tests require the students to label drawings.

   e. My tests often require the students to write out definitions to words. Often the students must label drawings. The tests do not require the use of mathematics to answer the questions. I do not discuss the test questions in class.

5. How do you conduct your laboratory?

   a. My students and I spend time before an experiment discussing the purposes of the experiment. I often allow the students to try their own ways of doing the laboratory experiment. The students can compare their answers to those of others when they are finished. They are allowed to do the experiments on their own.

   b. My students and I spend time before most experiments discussing the purposes of the experiment. The data one student gathers from an experiment are often different from the data gathered by another student. I allow the students to do some experimenting on their own.

   c. My students and I sometimes discuss the purposes of an experiment. The students sometimes may compare their answers to those of others when they are finished. I allow less than one-third of classtime for laboratory experiments.

   d. I sometimes conduct the laboratory in such a way that the students know the answers to a question before they do an experiment. My students and I seldom discuss the purposes of an experiment. I allow less than one-fourth of the classtime for laboratory experiments.

   e. I do not allow students to do experiments on their own. I conduct the laboratory in such a way that the students know the answers to a question before they do the experiment. I do not discuss the purpose of an experiment. I allow very little classtime for laboratory experiments.

END OF QUESTIONNAIRE

CAST: TP

ANSWER SHEET

Name of School ______________________________

Please CIRCLE the response that BEST fits your answer.

1.	Does Take Place	a	b	c	d	e
	Should Take Place	a	b	c	d	e
2.	Does Take Place	a	b	c	d	e
	Should Take Place	a	b	c	d	e
3.	Does Take Place	a	b	c	d	e
	Should Take Place	a	b	c	d	e
4.	Does Take Place	a	b	c	d	e
	Should Take Place	a	b	c	d	e
5.	Does Take Place	a	b	c	d	e
	Should Take Place	a	b	c	d	e

THANK YOU FOR YOUR COOPERATION

Please Return Answer Sheet To:

Hussein Bashir Mahmoud, Graduate Research Associate
SMEAC Information Reference Center
1200 Chambers Road, Room 310
Columbus, OH 43212
Phone: (614) 422-6717

SMEAC Information Reference Center
College of Education
The Ohio State University
1200 Chambers Road, Room 310
Columbus, OH 43212

STATE SCIENCE SUPERVISOR QUESTIONNAIRE

State Name ________________________________
Position ________________________________
Address ________________________________
____

The purpose of this questionnaire is to provide important information about your state science program. Please complete.

1. What does your state require in science for graduation from high school (9-12)? Please specify (credits, units, years of science, etc.)
____
____
____

2. Did your state have the same graduation requirements in science in 1970-71? (Circle one)———————— Yes No

If no, please specify what the requirement was.
____
____

3. Does your state currently have specific competency requirements in science? (Circle one)———————— Yes No

If yes, please specify or include the requirements.
____
____
____

4. Did your state have specific competency requirements in science in 1970-71? (Circle one)———————— Yes No

5. Do you believe that there will be changes in those requirements in the near future? (Circle one)—————— Yes No

If yes, please specify what do you expect the changes will be:
____
____
____
____

END OF QUESTIONNAIRE

THANK YOU FOR YOUR COOPERATION

APPENDIX C

All the Variables of all instruments

List of all variables, names, coding, computer card number and column number (s) of: (Q:SP), (Q:ST), (Q:AP), (Q:AT), (CAST:PP) and (CAST:TP)

Variables of the Principal's Questionnaire for the Status of Science Teaching in Public Secondary Schools (Q:SP)

CARD #5

Variable #'s	Variable	Coding	Column #
ID			1-12
		Blank	13
I. School Organization			
1	Grade 7-9	1 = yes, 0 = no	14
2	Grade 9-12	1 = yes, 0 = no	15
3	Grade 10-12	1 = yes, 0 = no	16
4	Other	1 = yes, 0 = no	17
5	Enrollment for grade 7	number	18-21
6	Enrollment for grade 8	number	22-25
7	Enrollment for grade 9	number	26-29
8	Enrollment for grade 10	number	30-33
9	Enrollment for grade 11	number	34-37
10	Enrollment for grade 12	number	38-41
11	Total		42-45
12	Decrease in students enrollment	1 = yes, 0 = no	46
13	No change in students enrollment	1 = yes, 0 = no	47
14	Increase in students enrollment	1 = yes, 0 = no	48
15	Trend in students enrollment	1 = decrease 2 = no change 3 = increase	49
16	Decrease in enrollment percentage	1 = yes, 0 = no	50
17	No change in enrollment percentage	1 = yes, 0 = no	51
18	Increase in enrollment percentage	1 = yes, 0 = no	52
19	Trend in enrollment percentage	1 = decrease 2 = no change 3 = increase	53
20	Less than one year as requirement	1 = yes, 0 = no	54
21	One year as requirement	1 = yes, 0 = no	55
22	More than one year as requirement	1 = yes, 0 = no	56
23	Requirement for science	1 = less than one year 2 = one year 3 = more than one year	57
24	Time required more than one year	1 = yes, 0 = no	58
25	Courses required	1 = yes, 0 = no	59
26	List of required courses	1 = yes, 0 = no	60
II. Principal			
27	Working in the school	1 = yes, 0 = no	61
28	Working as administrator	1 = yes, 0 = no	62
29	Working as teacher	1 = yes, 0 = no	63
30	Number of years as principal	number	64-65
III. Science Teachers			
31	Number of male Sc teachers	number	66-67
32	Number of female Sc teachers	number	68-69
33	Number of male Sc teachers with 0-20% assignment	number	70-71
34	Number of female Sc teachers with 0-20% assignment	number	72-73
35	Total number of Sc teachers with 0-20% assignment	number	74-75
36	Number of male Sc teachers with 21-40% assignment	number	76-77
		blank	78
Card ID		05 = Card #5	79-80

CARD #6

ID			1-12
		Blank	13
37	Number of female Sc teachers with 21-40% assignment	number	14-15
38	Total number of Sc teachers with 21-40% assignment	number	16-17
39	Number of male Sc teachers with 41-60% assignment	number	18-19
40	Number of female Sc teachers with 41-60% assignment	number	20-21
41	Total number of Sc teachers with 41-60% assignment	number	22-23
42	Number of male Sc teachers with 61-80% assignment	number	24-25
43	Number of female Sc teachers with 61-80% assignment	number	26-27
44	Total number of Sc teachers with 61-80% assignment	number	28-29
45	Number of male Sc teachers with 81-100% assignment	number	30-31
46	Number of female Sc teachers with 81-100% assignment	number	32-33
47	Total number of Sc teachers with 81-100% assignment	number	34-35

IV. Science Budget

48	Sc equipment budget	1 = yes, 0 = no	36
49	Equipment budget per student	number	37-38
50	Sc supplies budget	1 = yes, 0 = no	39
51	Supplies budget per student	number	40-41
52	Teacher purchase equip and supplies	1 = yes, 0 = no	42
53	School budget for textbooks	1 = yes, 0 = no	43
54	Books budget per student	number	44-45
55	Budget cuts	1 = yes, 0 = no	46
56	Increase of class size	1 = yes, 0 = no	47
57	More teaching from textbooks	1 = yes, 0 = no	48
58	Less money for instruction of materials	1 = yes, 0 = no	49
59	Good teachers leave	1 = yes, 0 = no	50
60	Optional courses reduced	1 = yes, 0 = no	51
61	Inservice training reduced	1 = yes, 0 = no	52
62	Students purchase books	1 = yes, 0 = no	53
63	Teaching subjects with little preparation	1 = yes, 0 = no	54
64	Other	1 = yes, 0 = no	55

V. Course Offerings

Biology or Life Science

65	Use of BSCS Green	1 = use 0 = no use	56
66	Enrollment in BSCS Green in grade 7	1 = yes, 0 = no	57
67	Enrollment in BSCS Green in grade 8	1 = yes, 0 = no	58
68	Enrollment in BSCS Green in grade 9	1 = yes, 0 = no	59
69	Enrollment in BSCS Green in grade 10	1 = yes, 0 = no	60
70	Enrollment in BSCS Green in grade 11	1 = yes, 0 = no	61
71	Enrollment in BSCS Green in grade 12	1 = yes, 0 = no	62
72	Use of BSCS Yellow	1 = use 0 = no use	63
73	Enrollment in BSCS Yellow in grade 7	1 = yes, 0 = no	64
74	Enrollment in BSCS Yellow in grade 8	1 = yes, 0 = no	65
75	Enrollment in BSCS Yellow in grade 9	1 = yes, 0 = no	66

76	Enrollment in BSCS Yellow in grade 10	1 = yes, 0 = no	67
77	Enrollment in BSCS Yellow in grade 11	1 = yes, 0 = no	68
78	Enrollment in BSCS Yellow in grade 12	1 = yes, 0 = no	69
79	Use of BSCS (Interaction of Exp)	1 = yes, 0 = no	70
80	Enrollment in BSCS Interaction in grade 7	1 = yes, 0 = no	71
81	Enrollment in BSCS Interaction in grade 8	1 = yes, 0 = no	72
82	Enrollment in BSCS Interaction in grade 9	1 = yes, 0 = no	73
83	Enrollment in BSCS Interaction in grade 10	1 = yes, 0 = no	74
84	Enrollment in BSCS Interaction in grade 11	1 = yes, 0 = no	75
85	Enrollment in BSCS Interaction in grade 12	1 = yes, 0 = no	76
86	Use of Me and My Environment	1 = use 0 = no use	77
87	Enrollment in Me an My Environment	1 = yes, 0 = no	78
Card ID		06 = Card #6	79-80

CARD #7

ID			1-12
		Blank	13
88	Enrollment in Me and My Environment in grade 8	1 = yes, 0 = no	14
89	Enrollment in Me and My Environment in grade 9	1 = yes, 0 = no	15
90	Enrollment in Me and My Environment in grade 10	1 = yes, 0 = no	16
91	Enrollment in Me and My Environment in grade 11	1 = yes, 0 = no	17
92	Enrollment in Me and My Environment in grade 12	1 = yes, 0 = no	18
93	Use of BSCS Blue	1 = use 0 = no use	19
94	Enrollment in BSCS Blue in grade 7	1 = yes, 0 = no	20
95	Enrollment in BSCS Blue in grade 8	1 = yes, 0 = no	21
96	Enrollment in BSCS Blue in grade 9	1 = yes, 0 = no	22
97	Enrollment in BSCS Blue in grade 10	1 = yes, 0 = no	23
98	Enrollment in BSCS Blue in grade 11	1 = yes, 0 = no	24
99	Enrollment in BSCS Blue in grade 12	1 = yes, 0 = no	25
100	Use of Patterns and Processes (BSCS)	1 = use 0 = no use	26
101	Enrollment in Patterns and Processes in grade 7	1 = yes, 0 = no	27
102	Enrollment in Patterns and Processes in grade 8	1 = yes, 0 = no	28
103	Enrollment in Patterns and Processes in grade 9	1 = yes, 0 = no	29
104	Enrollment in Patterns and Processes in grade 10	1 = yes, 0 = no	30
105	Enrollment in Patterns and Processes in grade 11	1 = yes, 0 = no	31
106	Enrollment in Patterns and Processes in grade 12	1 = yes, 0 = no	32
107	Use of Nason	1 = use 0 = no use	33
108	Enrollment in Nason in grade 7	1 = yes, 0 = no	34
109	Enrollment in Nason in grade 8	1 = yes, 0 = no	35
110	Enrollment in Nason in grade 9	1 = yes, 0 = no	36
111	Enrollment in Nason in grade 10	1 = yes, 0 = no	37
112	Enrollment in Nason in grade 11	1 = yes, 0 = no	38
113	Enrollment in Nason in grade 12	1 = yes, 0 = no	39

114	Use of Oram	1 = use 0 = no use	40
115	Enrollment in Oram in grade 7	1 = yes, 0 = no	41
116	Enrollment in Oram in grade 8	1 = yes, 0 = no	42
117	Enrollment in Oram in grade 9	1 = yes, 0 = no	43
118	Enrollment in Oram in grade 10	1 = yes, 0 = no	44
119	Enrollment in Oram in grade 11	1 = yes, 0 = no	45
120	Enrollment in Oram in grade 12	1 = yes, 0 = no	46
121	Use of Kroeber	1 = use 0 = no use	47
122	Enrollment in Kroeber in grade 7	1 = yes, 0 = no	48
123	Enrollment in Kroeber in grade 8	1 = yes, 0 = no	49
124	Enrollment in Kroeber in grade 9	1 = yes, 0 = no	50
125	Enrollment in Kroeber in grade 10	1 = yes, 0 = no	51
126	Enrollment in Kroeber in grade 11	1 = yes, 0 = no	52
127	Enrollment in Kroeber in grade 12	1 = yes, 0 = no	53
128	Use of Smallwood	1 = use 0 = no use	54
129	Enrollment in Smallwood in grade 7	1 = yes, 0 = no	55
130	Enrollment in Smallwood in grade 8	1 = yes, 0 = no	56
131	Enrollment in Smallwood in grade 9	1 = yes, 0 = no	57
132	Enrollment in Smallwood in grade 10	1 = yes, 0 = no	58
133	Enrollment in Smallwood in grade 11	1 = yes, 0 = no	59
134	Enrollment in Smallwood in grade 12	1 = yes, 0 = no	60
135	Use of Heimler	1 = use 0 = no use	61
136	Enrollment in Heimler in grade 7	1 = yes, 0 = no	62
137	Enrollment in Heimler in grade 8	1 = yes, 0 = no	63
138	Enrollment in Heimler in grade 9	1 = yes, 0 = no	64
139	Enrollment in Heimler in grade 10	1 = yes, 0 = no	65
140	Enrollment in Heimler in grade 11	1 = yes, 0 = no	66
141	Enrollment in Heimler in grade 12	1 = yes, 0 = no	67
142	Use of Human Sciences (BSCS)	1 = use 0 = no use	68
143	Enrollment in Human Sciences in grade 7	1 = yes, 0 = no	69
144	Enrollment in Human Sciences in grade 8	1 = yes, 0 = no	70
145	Enrollment in Human Sciences in grade 9	1 = yes, 0 = no	71
146	Enrollment in Human Sciences in grade 10	1 = yes, 0 = no	72
147	Enrollment in Human Sciences in grade 11	1 = yes, 0 = no	73
148	Enrollment in Human Sciences in grade 12	1 = yes, 0 = no	74
149	Use of Abraham	1 = use 0 = no use	75
150	Enrollment in Abraham in grade 7	1 = yes, 0 = no	76
151	Enrollment in Abraham in grade 8	1 = yes, 0 = no	77
152	Enrollment in Abraham in grade 9	1 = yes, 0 = no	78
Card ID		07 = Card #7	79-80

CARD #8

ID			1-12
		Blank	13
153	Enrollment in Abraham in grade 10	1 = yes, 0 = no	14
154	Enrollment in Abraham in grade 11	1 = yes, 0 = no	15
155	Enrollment in Abraham in grade 12	1 = yes, 0 = no	16
156	Use of Navarra	1 = use 0 = no use	17
157	Enrollment in Navarra in grade 7	1 = yes, 0 = no	18
158	Enrollment in Navarra in grade 8	1 = yes, 0 = no	19
159	Enrollment in Navarra in grade 9	1 = yes, 0 = no	20
160	Enrollment in Navarra in grade 10	1 = yes, 0 = no	21
161	Enrollment in Navarra in grade 11	1 = yes, 0 = no	22
162	Enrollment in Navarra in grade 12	1 = yes, 0 = no	23
163	Use of Life: Its forms and changes	1 = use 0 = no use	24
164	Enrollment in Life in grade 7	1 = yes, 0 = no	25
165	Enrollment in Life in grade 8	1 = yes, 0 = no	26
166	Enrollment in Life in grade 9	1 = yes, 0 = no	27
167	Enrollment in Life in grade 10	1 = yes, 0 = no	28
168	Enrollment in Life in grade 11	1 = yes, 0 = no	29
169	Enrollment in Life in grade 12	1 = yes, 0 = no	30
170	Use of Living Things	1 = use 0 = no use	31
171	Enrollment in Living Things in grade 7	1 = yes, 0 = no	32
172	Enrollment in Living Things in grade 8	1 = yes, 0 = no	33
173	Enrollment in Living Things in grade 9	1 = yes, 0 = no	34
174	Enrollment in Living Things in grade 10	1 = yes, 0 = no	35
175	Enrollment in Living Things in grade 11	1 = yes, 0 = no	36
176	Enrollment in Living Things in grade 12	1 = yes, 0 = no	37
177	Use of Modern Biology (Otto)	1 = use 0 = no use	38
178	Enrollment in Otto in grade 7	1 = yes, 0 = no	39
179	Enrollment in Otto in grade 8	1 = yes, 0 = no	40
180	Enrollment in Otto in grade 9	1 = yes, 0 = no	41
181	Enrollment in Otto in grade 10	1 = yes, 0 = no	42
182	Enrollment in Otto in grade 11	1 = yes, 0 = no	43
183	Enrollment in Otto in grade 12	1 = yes, 0 = no	44
184	Other Biology Texts or Courses	1 = yes, 0 = no	45
	Chemistry		
185	Use of Primentel	1 = use 0 = no use	46
186	Enrollment in Primentel in grade 7	1 = yes, 0 = no	47
187	Enrollment in Primentel in grade 8	1 = yes, 0 = no	48
188	Enrollment in Primentel in grade 9	1 = yes, 0 = no	49
189	Enrollment in Primentel in grade 10	1 = yes, 0 = no	50
190	Enrollment in Primentel in grade 11	1 = yes, 0 = no	51
191	Enrollment in Primentel in grade 12	1 = yes, 0 = no	52
192	Use of Cotton	1 = use 0 = no use	53
193	Enrollment in Cotton in grade 7	1 = yes, 0 = no	54
194	Enrollment in Cotton in grade 8	1 = yes, 0 = no	55
195	Enrollment in Cotton in grade 9	1 = yes, 0 = no	56
196	Enrollment in Cotton in grade 10	1 = yes, 0 = no	57

197	Enrollment in Cotton in grade 11	1 = yes, 0 = no	58
198	Enrollment in Cotton in grade 12	1 = yes, 0 = no	59
199	Use of CHEMS	1 = use = no use	60
200	Enrollment in CHEMS in grade 7	1 = yes, 0 = no	61
201	Enrollment in CHEMS in grade 8	1 = yes, 0 = no	62
202	Enrollment in CHEMS in grade 9	1 = yes, 0 = no	63
203	Enrollment in CHEMS in grade 10	1 = yes, 0 = no	64
204	Enrollment in CHEMS in grade 11	1 = yes, 0 = no	65
205	Enrollment in CHEMS in grade 12	1 = yes, 0 = no	66
206	Use of Sienko	1 = use 0 = no use	67
207	Enrollment in Sienko in grade 7	1 = yes, 0 = no	68
208	Enrollment in Sienko in grade 8	1 = yes, 0 = no	69
209	Enrollment in Sienko in grade 9	1 = yes, 0 = no	70
210	Enrollment in Sienko in grade 10	1 = yes, 0 = no	71
211	Enrollment in Sienko in grade 11	1 = yes, 0 = no	72
212	Enrollment in Sienko in grade 12	1 = yes, 0 = no	73
213	Use of IAC	1 = use 0 = no use	74
214	Enrollment in IAC in grade 7	1 = yes, 0 = no	75
215	Enrollment in IAC in grade 8	1 = yes, 0 = no	76
216	Enrollment in IAC in grade 9	1 = yes, 0 = no	77
217	Enrollment in IAC in grade 10	1 = yes, 0 = no	78
Card ID		08 = Card #8	79-80

CARD #9

ID			1-12
		Blank	13
218	Enrollment in IAC in grade 11	1 = yes, 0 = no	14
219	Enrollment in IAC in grade 12	1 = yes, 0 = no	15
220	Use of Modern Chemistry (Metcalfe)	1 = use 0 = no use	16
221	Enrollment in Metcalfe in grade 7	1 = yes, 0 = no	17
222	Enrollment in Metcalfe in grade 8	1 = yes, 0 = no	18
223	Enrollment in Metcalfe in grade 9	1 = yes, 0 = no	19
224	Enrollment in Metcalfe in grade 10	1 = yes, 0 = no	20
225	Enrollment in Metcalfe in grade 11	1 = yes, 0 = no	21
226	Enrollment in Metcalfe in grade 12	1 = yes, 0 = no	22
227	Other Chemistry texts or courses	1 = yes, 0 = no	23

Physics

228	Use of College Physics (Schaum)	1 = use 0 = no use	24
229	Enrollment in College Physics in grade 7	1 = yes, 0 = no	25
230	Enrollment in College Physics in grade 8	1 = yes, 0 = no	26
231	Enrollment in College Physics in grade 9	1 = yes, 0 = no	27
232	Enrollment in College Physics in grade 10	1 = yes, 0 = no	28
233	Enrollment in College Physics in grade 11	1 = yes, 0 = no	29
234	Enrollment in College Physics in grade 12	1 = yes, 0 = no	30
235	Use of Modern Physics (Williams)	1 = use 0 = no use	31
236	Enrollment in Williams in grade 7	1 = yes, 0 = no	32
237	Enrollment in Williams in grade 8	1 = yes, 0 = no	33
238	Enrollment in Williams in grade 9	1 = yes, 0 = no	34
239	Enrollment in Williams in grade 10	1 = yes, 0 = no	35
240	Enrollment in Williams in grade 11	1 = yes, 0 = no	36

241	Enrollment in Williams in grade 12	1 = yes, 0 = no	37
242	Use of PSSC	1 = use 0 = no use	38
243	Enrollment in PSSC in grade 7	1 = yes, 0 = no	39
244	Enrollment in PSSC in grade 8	1 = yes, 0 = no	40
245	Enrollment in PSSC in grade 9	1 = yes, 0 = no	41
246	Enrollment in PSSC in grade 10	1 = yes, 0 = no	42
247	Enrollment in PSSC in grade 11	1 = yes, 0 = no	43
248	Enrollment in PSSC in grade 12	1 = yes, 0 = no	44
249	Use of Project Physics	1 = use 0 = no use	45
250	Enrollment in Project Physics in grade 7	1 = yes, 0 = no	46
251	Enrollment in Project Physics in grade 8	1 = yes, 0 = no	47
252	Enrollment in Project Physics in grade 9	1 = yes, 0 = no	48
253	Enrollment in Project Physics in grade 10	1 = yes, 0 = no	49
254	Enrollment in Project Physics in grade 11	1 = yes, 0 = no	50
255	Enrollment in Project Physics in grade 12	1 = yes, 0 = no	51
256	Other Physics Texts or Courses	1 = yes, 0 = no	52
	Physical Science		
257	Use of Abraham	1 = use 0 = no use	53
258	Enrollment in Abraham in grade 7	1 = yes, 0 = no	54
259	Enrollment in Abraham in grade 8	1 = yes, 0 = no	55
260	Enrollment in Abraham in grade 9	1 = yes, 0 = no	56
261	Enrollment in Abraham in grade 10	1 = yes, 0 = no	57
262	Enrollment in Abraham in grade 11	1 = yes, 0 = no	58
263	Enrollment in Abraham in grade 12	1 = yes, 0 = no	59
264	Use of IPS	1 = use 0 = no use	60
265	Enrollment in IPS in grade 7	1 = yes, 0 = no	61
266	Enrollment in IPS in grade 8	1 = yes, 0 = no	62
267	Enrollment in IPS in grade 9	1 = yes, 0 = no	63
268	Enrollment in IPS in grade 10	1 = yes, 0 = no	64
269	Enrollment in IPS in grade 11	1 = yes, 0 = no	65
270	Enrollment in IPS in grade 12	1 = yes, 0 = no	66
271	Use of Modern Physical Sc (Tracy)	1 = use 0 = no use	67
272	Enrollment in Tracy in grade 7	1 = yes, 0 = no	68
273	Enrollment in Tracy in grade 8	1 = yes, 0 = no	69
274	Enrollment in Tracy in grade 9	1 = yes, 0 = no	70
275	Enrollment in Tracy in grade 10	1 = yes, 0 = no	71
276	Enrollment in Tracy in grade 11	1 = yes, 0 = no	72
277	Enrollment in Tracy in grade 12	1 = yes, 0 = no	73
278	Use of Physical Science II	1 = use 0 = no use	74
279	Enrollment in PS II in grade 7	1 = yes, 0 = no	75
280	Enrollment in PS II in grade 8	1 = yes, 0 = no	76
281	Enrollment in PS II in grade 9	1 = yes, 0 = no	77
282	Enrollment in PS II in grade 10	1 = yes, 0 = no	78
Card ID		09 = Card #9	79-80

CARD #10

ID			1-12
		Blank	13
283	Enrollment in PS II in grade 11	1 = yes, 0 = no	14
284	Enrollment in PS II in grade 12	1 = yes, 0 = no	15
285	Use of ECCP	1 = use 0 = no use	16
286	Enrollment in ECCP in grade 7	1 = yes, 0 = no	17
287	Enrollment in ECCP in grade 8	1 = yes, 0 = no	18
288	Enrollment in ECCP in grade 9	1 = yes, 0 = no	19

289	Enrollment in ECCP in grade 10	1 = yes, 0 = no	20
290	Enrollment in ECCP in grade 11	1 = yes, 0 = no	21
291	Enrollment in ECCP in grade 12	1 = yes, 0 = no	22
292	Other	1 = yes, 0 = no	23

Earth Science

293	Use of Namowitz	1 = use 0 = no use	24
294	Enrollment in Namowitz in grade 7	1 = yes, 0 = no	25
295	Enrollment in Namowitz in grade 8	1 = yes, 0 = no	26
296	Enrollment in Namowitz in grade 9	1 = yes, 0 = no	27
297	Enrollment in Namowitz in grade 10	1 = yes, 0 = no	28
298	Enrollment in Namowitz in grade 11	1 = yes, 0 = no	29
299	Enrollment in Namowitz in grade 12	1 = yes, 0 = no	30
300	Use of Bishop	1 = use 0 = no use	31
301	Enrollment in Bishop in grade 7	1 = yes, 0 = no	32
302	Enrollment in Bishop in grade 8	1 = yes, 0 = no	33
303	Enrollment in Bishop in grade 9	1 = yes, 0 = no	34
304	Enrollment in Bishop in grade 10	1 = yes, 0 = no	35
305	Enrollment in Bishop in grade 11	1 = yes, 0 = no	36
306	Enrollment in Bishop in grade 12	1 = yes, 0 = no	37
307	Use of ESCP	1 = use 0 = no use	38
308	Enrollment in ESCP in grade 7	1 = yes, 0 = no	39
309	Enrollment in ESCP in grade 8	1 = yes, 0 = no	40
310	Enrollment in ESCP in grade 9	1 = yes, 0 = no	41
311	Enrollment in ESCP in grade 10	1 = yes, 0 = no	42
312	Enrollment in ESCP in grade 11	1 = yes, 0 = no	43
313	Enrollment in ESCP in grade 12	1 = yes, 0 = no	44
314	Use of Ramsey	1 = use 0 = no use	45
315	Enrollment in Ramsey in grade 7	1 = yes, 0 = no	46
316	Enrollment in Ramsey in grade 8	1 = yes, 0 = no	47
317	Enrollment in Ramsey in grade 9	1 = yes, 0 = no	48
318	Enrollment in Ramsey in grade 10	1 = yes, 0 = no	49
319	Enrollment in Ramsey in grade 11	1 = yes, 0 = no	50
320	Enrollment in Ramsey in grade 12	1 = yes, 0 = no	51
321	Use of TSM	1 = use 0 = no use	52
322	Enrollment in TSM in grade 7	1 = yes, 0 = no	53
323	Enrollment in TSM in grade 8	1 = yes, 0 = no	54
324	Enrollment in TSM in grade 9	1 = yes, 0 = no	55
325	Enrollment in TSM in grade 10	1 = yes, 0 = no	56
326	Enrollment in TSM in grade 11	1 = yes, 0 = no	57
327	Enrollment in TSM in grade 12	1 = yes, 0 = no	58
328	Other Earth Science Texts or Courses	1 = yes, 0 = no	59

Other Courses or Textbooks

329	Use of ISIS	1 = yes, 0 = no	60
330	Enrollment in ISIS in grade 7	1 = yes, 0 = no	61
331	Enrollment in ISIS in grade 8	1 = yes, 0 = no	62
332	Enrollment in ISIS in grade 9	1 = yes, 0 = no	63
333	Enrollment in ISIS in grade 10	1 = yes, 0 = no	64
334	Enrollment in ISIS in grade 11	1 = yes, 0 = no	65
335	Enrollment in ISIS in grade 12	1 = yes, 0 = no	66
336	Use of Blanc	1 = use 0 = no use	67
337	Enrollment in Blanc in grade 7	1 = yes, 0 = no	68
338	Enrollment in Blanc in grade 8	1 = yes, 0 = no	69
339	Enrollment in Blanc in grade 9	1 = yes, 0 = no	70
340	Enrollment in Blanc in grade 10	1 = yes, 0 = no	71
341	Enrollment in Blanc in grade 11	1 = yes, 0 = no	72
342	Enrollment in Blanc in grade 12	1 = yes, 0 = no	73

343	Use of Heimler	1 = use 0 = no use	74
344	Enrollment in Heimler in grade 7	1 = yes, 0 = no	75
345	Enrollment in Heimler in grade 8	1 = yes, 0 = no	76
346	Enrollment in Heimler in grade 9	1 = yes, 0 = no	77
347	Enrollment in Heimler in grade 10	1 = yes, 0 = no	78
Card ID		10 = Card #10	79-80

CARD #11

ID			1-12
		Blank	13
348	Enrollment in Heimler in grade 11	1 = yes, 0 = no	14
349	Enrollment in Heimler in grade 12	1 = yes, 0 = no	15
350	Use of ISCS	1 = use 0 = no use	16
351	Enrollment in ISCS in grade 7	1 = yes, 0 = no	17
352	Enrollment in ISCS in grade 8	1 = yes, 0 = no	18
353	Enrollment in ISCS in grade 9	1 = yes, 0 = no	19
354	Enrollment in ISCS in grade 10	1 = yes, 0 = no	20
355	Enrollment in ISCS in grade 11	1 = yes, 0 = no	21
356	Enrollment in ISCS in grade 12	1 = yes, 0 = no	22
357	Use of Gross	1 = use 0 = no use	23
358	Enrollment in Gross in grade 7	1 = yes, 0 = no	24
359	Enrollment in Gross in grade 8	1 = yes, 0 = no	25
360	Enrollment in Gross in grade 9	1 = yes, 0 = no	26
361	Enrollment in Gross in grade 10	1 = yes, 0 = no	27
362	Enrollment in Gross in grade 11	1 = yes, 0 = no	28
363	Enrollment in Gross in grade 12	1 = yes, 0 = no	29
364	Other Texts of Courses	1 = yes, 0 = no	30
365	Offering a General Science Course	1 = yes, 0 = no	31
366	Using a general science text	1 = use 0 = no use	32
367	Enrollment in general science in grade 7	1 = yes, 0 = no	33
368	Enrollment in general science in grade 8	1 = yes, 0 = no	34
369	Enrollment in general science in grade 9	1 = yes, 0 = no	35
370	Enrollment in general science in grade 10	1 = yes, 0 = no	36
371	Enrollment in general science in grade 11	1 = yes, 0 = no	37
372	Enrollment in general science in grade 12	1 = yes, 0 = no	38
373	Offering specialized courses	1 = yes, 0 = no	39
374	Use of Astronomy	1 = use 0 = no use	40
375	Use of Astronomy Textbook	1 = use 0 = no use	41
376	Enrollment in Astronomy in grade 7	1 = yes, 0 = no	42
377	Enrollment in Astronomy in grade 8	1 = yes, 0 = no	43
378	Enrollment in Astronomy in grade 9	1 = yes, 0 = no	44
379	Enrollment in Astronomy in grade 10	1 = yes, 0 = no	45
380	Enrollment in Astronomy in grade 11	1 = yes, 0 = no	46
381	Enrollment in Astronomy in grade 12	1 = yes, 0 = no	47
382	Use of Physiology	1 = use 0 = no use	48
383	Use Physiology textbooks	1 = yes, 0 = no	49
384	Enrollment in Physiology in grade 7	1 = yes, 0 = no	50
385	Enrollment in Physiology in grade 8	1 = yes, 0 = no	51
386	Enrollment in Physiology in grade 9	1 = yes, 0 = no	52

387	Enrollment in Physiology in grade 10	1 = yes, 0 = no	53
388	Enrollment in Physiology in grade 11	1 = yes, 0 = no	54
389	Enrollment in Physiology in grade 12	1 = yes, 0 = no	55
390	Use of Zoology	1 = use 0 = no use	56
391	Use of Zoology textbooks	1 = use 0 = no use	57
392	Enrollment in Zoology in grade 7	1 = yes, 0 = no	58
393	Enrollment in Zoology in grade 8	1 = yes, 0 = no	59
394	Enrollment in Zoology in grade 9	1 = yes, 0 = no	60
395	Enrollment in Zoology in grade 10	1 = yes, 0 = no	61
396	Enrollment in Zoology in grade 11	1 = yes, 0 = no	62
397	Enrollment in Zoology in grade 12	1 = yes, 0 = no	63
398	Use of Botany	1 = use 0 = no use	64
399	Use of Botany textbooks	1 = use 0 = no use	65
400	Enrollment in Botany in grade 7	1 = yes, 0 = no	66
401	Enrollment in Botany in grade 8	1 = yes, 0 = no	67
402	Enrollment in Botany in grade 9	1 = yes, 0 = no	68
403	Enrollment in Botany in grade 10	1 = yes, 0 = no	69
404	Enrollment in Botany in grade 11	1 = yes, 0 = no	70
405	Enrollment in Botany in grade 12	1 = yes, 0 = no	71
406	Use of Oceanography	1 = use 0 = no use	72
407	Use of Oceanography textbooks	1 = use 0 = no use	73
408	Enrollment in Oceanography in grade 7	1 = yes, 0 = no	74
409	Enrollment in Oceanography in grade 8	1 = yes, 0 = no	75
410	Enrollment in Oceanography in grade 9	1 = yes, 0 = no	76
411	Enrollment in Oceanography in grade 10	1 = yes, 0 = no	77 77
412	Enrollment in Oceanography in grade 11	1 = yes, 0 = no	78
ID		11 = Card #11	79-80

CARD #12

ID			12
		Blank	13
413	Enrollment in Oceanography in grade 12	1 = yes, 0 = no	14
414	Use of Geology	1 = use 0 = no use	15
415	Use of Geology textbooks	1 = use 0 = no use	16
416	Enrollment in Geology in grade 7	1 = yes, 0 = no	17
417	Enrollment in Geology in grade 8	1 = yes, 0 = no	18
418	Enrollment in Geology in grade 9	1 = yes, 0 = no	19
419	Enrollment in Geology in grade 10	1 = yes, 0 = no	20
420	Enrollment in Geology in grade 11	1 = yes, 0 = no	21
421	Enrollment in Geology in grade 12	1 = yes, 0 = no	22
422	Use of Advanced Biology	1 = use 0 = no use	23

423	Use of Advanced Biology textbooks	1 = use 0 = no use	24
424	Enrollment in Advanced Biology in grade 7	1 = yes, 0 = no	25
425	Enrollment in Advanced Biology in grade 8	1 = yes, 0 = no	26
426	Enrollment in Advanced Biology in grade 9	1 = yes, 0 = no	27
427	Enrollment in Advanced Biology in grade 10	1 = yes, 0 = no	28
428	Enrollment in Advanced Biology in grade 11	1 = yes, 0 = no	29
429	Enrollment in Advanced Biology in grade 12	1 = yes, 0 = no	30
430	Use of Advanced Chemistry	1 = use 0 = no use	31
431	Use of Advanced Chemistry textbooks	1 = use 0 = no use	32
432	Enrollment in Advanced Chemistry in grade 7	1 = yes, 0 = no	33
433	Enrollment in Advanced Chemistry in grade 8	1 = yes, 0 = no	34
434	Enrollment in Advanced Chemistry in grade 9	1 = yes, 0 = no	35
435	Enrollment in Advanced Chemistry in grade 10	1 = yes, 0 = no	36
436	Enrollment in Advanced Chemistry in grade 11	1 = yes, 0 = no	37
437	Enrollment in Advanced Chemistry in grade 12	1 = yes, 0 = no	38
438	Use of Advanced Physics	1 = use 0 = no use	39
439	Use of Advanced Physics textbooks	1 = use 0 = no use	40
440	Enrollment in Advanced Physics in grade 7	1 = yes, 0 = no	41
441	Enrollment in Advanced Physics in grade 8	1 = yes, 0 = no	42
442	Enrollment in Advanced Physics in grade 9	1 = yes, 0 = no	43
443	Enrollment in Advanced Physics in grade 10	1 = yes, 0 = no	44
444	Enrollment in Advanced Physics in grade 11	1 = yes, 0 = no	45
445	Enrollment in Advanced Physics in grade 12	1 = yes, 0 = no	46
446	Use of Honors Science Program	1 = use 0 = no use	47
447	Use of HSP textbooks	1 = use 0 = no use	48
448	Enrollment in HSP in grade 7	1 = yes, 0 = no	49
449	Enrollment in HSP in grade 8	1 = yes, 0 = no	50
450	Enrollment in HSP in grade 9	1 = yes, 0 = no	51
451	Enrollment in HSP in grade 10	1 = yes, 0 = no	52
452	Enrollment in HSP in grade 11	1 = yes, 0 = no	53
453	Enrollment in HSP in grade 12	1 = yes, 0 = no	54
454	Other Programs	1 = yes, 0 = no	55
455	Teaching Environmental Ed.	1 = yes, 0 = no	56
456	Teaching Environmental Ed. separately in grade 7	1 = yes, 0 = no	57
457	Teaching Environmental Ed separately in grade 8	1 = yes, 0 = no	58
458	Teaching Environmental Ed separately in grade 9	1 = yes, 0 = no	59
459	Teaching Environmental Ed separately in grade 10	1 = yes, 0 = no	60
460	Teaching Environmental Ed separately in grade 11	1 = yes, 0 = no	61
461	Teaching Environmental Ed separately in grade 12	1 = yes, 0 = no	62
462	Teaching Environmental Ed with Science in grade 7	1 = yes, 0 = no	63
463	Teaching Environmental Ed with Science in grade 8	1 = yes, 0 = no	64
464	Teaching Environmental Ed with Science in grade 9	1 = yes, 0 = no	65

465	Teaching Environmental Ed with Science in grade 10	1 = yes, 0 = no	66
466	Teaching Environmental Ed with Science in grade 11	1 = yes, 0 = no	67
467	Teaching Environmental Ed with Science in grade 12	1 = yes, 0 = no	68
468	Teaching Environmental Ed with Social Studies in grade 7	1 = yes, 0 = no	69
469	Teaching Environmental Ed with Social Studies in grade 8	1 = yes, 0 = no	70
470	Teaching Environmental Ed with Social Studies in grade 9	1 = yes, 0 = no	71
471	Teaching Environmental Ed with Social Studies in grade 10	1 = yes, 0 = no	72
472	Teaching Environmental Ed with Social Studies in grade 11	1 = yes, 0 = no	73
473	Teaching Environmental Ed with Social Studies in grade 12	1 = yes, 0 = no	74
474	Teaching Environmental Ed integrated with 2 or more subjects including science in grade 7	1 = yes, 0 = no	75
475	Teaching Environmental Ed integrated with 2 or more subjects including science in grade 8	1 = yes, 0 = no	76
476	Teaching Environmental Ed integrated with 2 or more subjects including science in grade 9	1 = yes, 0 = no	77
477	Teaching Environmental Ed integrated with 2 or more subjects including science in grade 10	1 = yes, 0 = no	78
Card ID		12 = Card #12	79-80

CARD #13

ID			1-12
		Blank	13
478	Teaching Environmental Ed integrated with 2 or more subjects including science in grade 11	1 = yes, 0 = no	14
479	Teaching Environmental Ed integrated with 2 or more subjects including science in grade 12	1 = yes, 0 = no	15
480	Teaching Environmental Ed integrated with 2 or more subjects not including science in grade 7	1 = yes, 0 = no	16
481	Teaching Environmental Ed integrated with 2 or more subjects not including science in grade 8	1 = yes, 0 = no	17
482	Teaching Environmental Ed integrated with 2 or more subjects not including science in grade 9	1 = yes, 0 = no	18
483	Teaching Environmental Ed integrated with 2 or more subjects not including science in grade 10	1 = yes, 0 = no	19
484	Teaching Environmental Ed integrated with 2 or more subjects not including science in grade 11	1 = yes, 0 = no	20
485	Teaching Environmental Ed integrated with 2 or more subjects not including science in grade 12	1 = yes, 0 = no	21
486	Other arrangement for Environmental Ed	1 = yes, 0 = no	22
487	Offering science for below average students	1 = yes, 0 = no	23
488	Offering science for gifted students	1 = yes, 0 = no	24

489	Principal's view of offering separate science courses for below average students	1 = yes, 0 = no	25
490	Principal's view of offering separate science courses for gifted students	1 = yes, 0 = no	26
		Blank	27-31

VI Change

491	Changes in science programs	1 = yes, 0 = no	32
492	Revised courses	1 = yes, 0 = no	33
493	Added courses	1 = yes, 0 = no	34
494	Eliminated courses	1 = yes, 0 = no	35
495	Changed textbooks	1 = yes, 0 = no	36
496	Developed new materials	1 = yes, 0 = no	37
497	Reduced student requirements	1 = yes, 0 = no	38
498	Increased student	1 = yes, 0 = no	39
499	Other	1 = yes, 0 = no	40
500	Principal's view of reasons for change	1 = yes, 0 = no	41
501	Principal's satisfaction with current science program	5 = Very Satisfied 4 = Satisfied 3 = Neutral 2 = Dissatisfied 1 = Very Dissatisfied	42
502	Principal's view of change	1 = yes, 0 = no	43
		Blank	44-78
Card ID		13 = Card #13	79-80

Variables of the Teacher's Questionnaire for the Status of Science Teaching in Public Secondary Schools (Q:ST)

CARD #5

Variable #'s	Variable	Coding	Column #
ID			1-12
		Blank	13
I. Teacher Characteristics			
1	Age	1 = 20-29 2 = 30-39 3 = 40-49 4 = 50-59 5 = 60-69	14
2	Sex	1 = male 0 = female	15
3	Highest degree held	1 = BS or BA 2 = MS or MA 3 = Ph.D.or Ed.D	16
	Subject Matter Fields		
4	Biology	2 = Major 1 = Minor 0 = Not Used	17
5	Chemistry		18
6	Physics		19
7	Physical Science		20
8	Earth Science		21
9	General Science		22
10	Other Subjects		23
11	Attendance of any NSF sponsored inservice activities	1 = yes, 0 = no	24
12	Academic Year Institutes	1 = yes, 0 = no	25
13	Administrators Conferences	1 = yes, 0 = no	26
14	Cooperative College School Science Program	1 = yes, 0 = no	27
15	Inservice Institutes	1 = yes, 0 = no	28
16	Resource Personnel Workshops	1 = yes, 0 = no	29
17	Summer Institutes	1 = yes, 0 = no	30
18	Other inservice activities projects to 74	1 = yes, 0 = no	31
19	Chautauqua Short Courses	1 = yes, 0 = no	32
20	Leadership Development Projects	1 = yes, 0 = no	33
21	School System Projects	1 = yes, 0 = no	34
22	Teacher Centered Projects	1 = yes, 0 = no	35
23	Other inservice activities after 74	1 = yes, 0 = no	36
II. Teaching Load			
24	Biology	1 = yes, 0 = no	37
25	Relation of Biology to Teacher's Major and Minor	2 = Biology Major 1 = Biology Minor 0 = Not Major or Minor	38
26	Class Size	number	39-40
27	Chemistry	1 = yes, 0 = no	41
28	Relation of Chemistry to Teacher's Major or Minor	2 = Major 1 = Minor 0 = Not major or minor	42
29	Class Size	number	43
30	Physics	1 = yes, 0 = no	44
31	Relation of Physics to Teacher's Major and Minor	2 = Mjr, 1 = Mnr 0 = Not mjr or mnr	46

32	Class Size	number	47-48
33	Physical Science	1 = yes, 0 = no	49
34	Relation of Physical Science to Teacher's Major and Minor	2 = Major 1 = Minor 0 = Not Major or Minor	50
35	Class Size	number	51-52
36	Earth Science	1 = yes, 0 = no	53
37	Relation of Earth Science to Teacher's Major and Minor	2 = Major 1 = Minor 0 = Not Major or Minor	54
38	Class Size	number	55-56
39	General Science	1 = yes, 0 = no	57
40	Relation of General Science to Teacher's Major and Minor	2 = Major 1 = Minor 0 = Not Major or Minor	58
41	Class Size	number	59-60
42	Other Subjects or Courses	1 = yes, 0 = no	61
43	Relation of others to Major and Minor	2 = Major 1 = Minor 0 = Not Major or Minor	62
44	Class Size	number	63-64

III. Special Science Facilities

45	Auto-tutorial lab Availability	1 = yes, 0 = no	65
46	Auto-tutorial lab Usage	3 = Often 2 = Occasionally 1 = Rarely	66
47	Closed-Circuit television Availability	1 = yes, 0 = no	67
48	Closed-Circuit television Usage	3 = Oft 2 = Occ, 1 = R	68
49	Broadcast television Availability	1 = yes, 0 = no	69
50	Broadcast television Usage	3 = Oft 2 = Occ, 1 = R	70
51	Videotape recorder/player Availability	1 = yes, 0 = no	71
52	Videotape recorder/player Usage	3 = Oft 2 = Occ, 1 = R	72
53	Ham radio station Availability	1 = yes, 0 = no	73
54	Ham radio station Usage	3 = Oft 2 = Occ, 1 = R	74
55	Greenhouse Availability	1 = yes, 0 = no	75
56	Greenhouse Usage	3 = Oft 2 = Occ, 1 = R	76
57	Land Laboratory Availability	1 = yes, 0 = no	77
58	Land Laboratory Usage	3 = Oft 2 = Occ, 1 = R	78
Card ID		05 = Card #05	79-80

CARD #6

ID			1-12
		Blank	13
59	Natural trail Availability	1 = yes, 0 = no	14
60	Natural trail Usage	3 = Oft 2 = Occ, 1 = R	15
61	Observatory Availability	1 = yes, 0 = no	16
62	Observatory Usage	3 = Oft 2 = Occ, 1 = R	17

63	Planetarium Availability	1 = yes, 0 = no	18
64	Planetarium Usage	3 = Oft 2 = Occ, 1 = R	19
65	Science darkroom Availability	1 = yes, 0 = no	20
66	Science darkroom Usage	3 = Oft 2 = Occ, 1 = R	21
67	Animal house Availability	1 = yes, 0 = no	22
68	Animal house Usage	3 = Oft 2 = Occ, 1 = R	23
69	Computer Availability	1 = yes, 0 = no	24
70	Computer Usage	3 = Oft 2 = Occ, 1 = R	25
71	Weather Station Availability	1 = yes, 0 = no	26
72	Weather Station Usage	3 = Oft 2 = Occ, 1 = R	27
73	Other science facility	1 = yes, 0 = no	28
74	Laboratory or special room usage	1 = yes, 0 = no	29
75	Classroom with no science facilities usage	1 = yes, 0 = no	30
76	Classroom with portable science kits usage	1 = yes, 0 = no	31
77	Other rooms	1 = yes, 0 = no	32

IV. Science Teaching

78	Use of single textbooks	1 = yes, 0 = no	33
79	Use of single texbooks including lab manuals	1 = yes, 0 = no	34
80	Use of multiple textbooks including lab manuals	1 = yes, 0 = no	35
81	Use of separate lab manuals	1 = yes, 0 = no	36
82	Use of multiple textbooks	1 = yes, 0 = no	37
83	Use of locally prepared materials	1 = yes, 0 = no	38
84	Other curriculum materials	1 = yes, 0 = no	39
		Blank	40-55

V. Course Offerings

Biology or Life Science

85	Use of BSCS Green	1 = use 0 = no use	56
86	Enrollment in BSCS Green in grade 7	1 = yes, 0 = no	57
87	Enrollment in BSCS Green in grade 8	1 = yes, 0 = no	58
88	Enrollment in BSCS Green in grade 9	1 = yes, 0 = no	59
89	Enrollment in BSCS Green in grade 10	1 = yes, 0 = no	60
90	Enrollment in BSCS Green in grade 11	1 = yes, 0 = no	61
91	Enrollment in BSCS Green in grade 12	1 = yes, 0 = no	62
92	Use of BSCS Yellow	1 = use 0 = no use	63
93	Enrollment in BSCS Yellow in grade 7	1 = yes, 0 = no	64
94	Enrollment in BSCS Yellow in grade 8	1 = yes, 0 = no	65
95	Enrollment in BSCS Yellow in grade 9	1 = yes, 0 = no	66

96	Enrollment in BSCS Yellow in grade 10	1 = yes, 0 = no	67
97	Enrollment in BSCS Yellow in grade 11	1 = yes, 0 = no	68
98	Enrollment in BSCS Yellow in grade 12	1 = yes, 0 = no	69
99	Use of BSCS (Interaction of Exp)	1 = yes, 0 = no	70
100	Enrollment in BSCS Interaction in grade 7	1 = yes, 0 = no	71
101	Enrollment in BSCS Interaction in grade 8	1 = yes, 0 = no	72
102	Enrollment in BSCS Interaction in grade 9	1 = yes, 0 = no	73
103	Enrollment in BSCS Interaction in grade 10	1 = yes, 0 = no	74
104	Enrollment in BSCS Interaction in grade 11	1 = yes, 0 = no	75
105	Enrollment in BSCS Interaction in grade 12	1 = yes, 0 = no	76
106	Use of Me and My Environment	1 = use 0 = no use	77
107	Enrollment in Me an My Environment	1 = yes, 0 = no	78
Card ID		06 = Card #6	79-80

CARD #7

ID			1-12
		Blank	13
108	Enrollment in Me and My Environment in grade 8	1 = yes, 0 = no	14
109	Enrollment in Me and My Environment in grade 9	1 = yes, 0 = no	15
110	Enrollment in Me and My Environment, in grade 10	1 = yes, 0 = no	16
111	Enrollment in Me and My Environment in grade 11	1 = yes, 0 = no	17
112	Enrollment in Me and My Environment in grade 12	1 = yes, 0 = no	18
113	Use of BSCS Blue	1 = use 0 = no use	19
114	Enrollment in BSCS Blue in grade 7	1 = yes, 0 = no	20
115	Enrollment in BSCS Blue in grade 8	1 = yes, 0 = no	21
116	Enrollment in BSCS Blue in grade 9	1 = yes, 0 = no	22
117	Enrollment in BSCS Blue in grade 10	1 = yes, 0 = no	23
118	Enrollment in BSCS Blue in grade 11	1 = yes, 0 = no	24
119	Enrollment in BSCS Blue in grade 12	1 = yes, 0 = no	25
120	Use of Patterns and Processes (BSCS)	1 = use 0 = no use	26
121	Enrollment in Patterns and Processes in grade 7	1 = yes, 0 = no	27
122	Enrollment in Patterns and Processes in grade 8	1 = yes, 0 = no	28
123	Enrollment in Patterns and Processes in grade 9	1 = yes, 0 = no	29
124	Enrollment in Patterns and Processes in grade 10	1 = yes, 0 = no	30
125	Enrollment in Patterns and Processes in grade 11	1 = yes, 0 = no	31
126	Enrollment in Patterns and Processes in grade 12	1 = yes, 0 = no	32
127	Use of Nason	1 = use 0 = no use	33
128	Enrollment in Nason in grade 7	1 = yes, 0 = no	34
129	Enrollment in Nason in grade 8	1 = yes, 0 = no	35
130	Enrollment in Nason in grade 9	1 = yes, 0 = no	36
131	Enrollment in Nason in grade 10	1 = yes, 0 = no	37
132	Enrollment in Nason in grade 11	1 = yes, 0 = no	38
133	Enrollment in Nason in grade 12	1 = yes, 0 = no	39

134	Use of Oram	1 = use 0 = no use	40
135	Enrollment in Oram in grade 7	1 = yes, 0 = no	41
136	Enrollment in Oram in grade 8	1 = yes, 0 = no	42
137	Enrollment in Oram in grade 9	1 = yes, 0 = no	43
138	Enrollment in Oram in grade 10	1 = yes, 0 = no	44
139	Enrollment in Oram in grade 11	1 = yes, 0 = no	45
140	Enrollment in Oram in grade 12	1 = yes, 0 = no	46
141	Use of Kroeber	1 = use 0 = no use	47
142	Enrollment in Kroeber in grade 7	1 = yes, 0 = no	48
143	Enrollment in Kroeber in grade 8	1 = yes, 0 = no	49
144	Enrollment in Kroeber in grade 9	1 = yes, 0 = no	50
145	Enrollment in Kroeber in grade 10	1 = yes, 0 = no	51
146	Enrollment in Kroeber in grade 11	1 = yes, 0 = no	52
147	Enrollment in Kroeber in grade 12	1 = yes, 0 = no	53
148	Use of Smallwood	1 = use 0 = no use	54
149	Enrollment in Smallwood in grade 7	1 = yes, 0 = no	55
150	Enrollment in Smallwood in grade 8	1 = yes, 0 = no	56
151	Enrollment in Smallwood in grade 9	1 = yes, 0 = no	57
152	Enrollment in Smallwood in grade 10	1 = yes, 0 = no	58
153	Enrollment in Smallwood in grade 11	1 = yes, 0 = no	59
154	Enrollment in,Smallwood in grade 12	1 = yes, 0 = no	60
155	Use of Heimler	1 = use 0 = no use	61
156	Enrollment in Heimler in grade 7	1 = yes, 0 = no	62
157	Enrollment in Heimler in grade 8	1 = yes, 0 = no	63
158	Enrollment in Heimler in grade 9	1 = yes, 0 = no	64
159	Enrollment in Heimler in grade 10	1 = yes, 0 = no	65
160	Enrollment in Heimler in grade 11	1 = yes, 0 = no	66
161	Enrollment in Heimler in grade 12	1 = yes, 0 = no	67
162	Use of Human Sciences (BSCS)	1 = use 0 = no use	68
163	Enrollment in Human Sciences in grade 7	1 = yes, 0 = no	69
164	Enrollment in Human Sciences in grade 8	1 = yes, 0 = no	70
165	Enrollment in Human Sciences in grade 9	1 = yes, 0 = no	71
166	Enrollment in Human Sciences in grade 10	1 = yes, 0 = no	72
167	Enrollment in Human Sciences in grade 11	1 = yes, 0 = no	73
168	Enrollment in Human Sciences in grade 12	1 = yes, 0 = no	74
169	Use of Abraham	1 = use 0 = no use	75
170	Enrollment in Abraham in grade 7	1 = yes, 0 = no	76
171	Enrollment in Abraham in grade 8	1 = yes, 0 = no	77
172	Enrollment in Abraham in grade 9	1 = yes, 0 = no	78
Card ID		07 = Card #7	79-80

ID			1-12
		Blank	13
173	Enrollment in Abraham in grade 10	1 = yes, 0 = no	14
174	Enrollment in Abraham in grade 11	1 = yes, 0 = no	15
175	Enrollment in Abraham in grade 12	1 = yes, 0 = no	16
176	Use of Navarra	1 = use 0 = no use	17
177	Enrollment in Navarra in grade 7	1 = yes, 0 = no	18
178	Enrollment in Navarra in grade 8	1 = yes, 0 = no	19
179	Enrollment in Navarra in grade 9	1 = yes, 0 = no	20
180	Enrollment in Navarra in grade 10	1 = yes, 0 = no	21
181	Enrollment in Navarra in grade 11	1 = yes, 0 = no	22
182	Enrollment in Navarra in grade 12	1 = yes, 0 = no	23
183	Use of Life: Its forms and changes	1 = use 0 = no use	24
184	Enrollment in Life in grade 7	1 = yes, 0 = no	25
185	Enrollment in Life in grade 8	1 = yes, 0 = no	26
186	Enrollment in Life in grade 9	1 = yes, 0 = no	27
187	Enrollment in Life in grade 10	1 = yes, 0 = no	28
188	Enrollment in Life in grade 11	1 = yes, 0 = no	29
189	Enrollment in Life in grade 12	1 = yes, 0 = no	30
190	Use of Living Things	1 = use 0 = no use	31
191	Enrollment in Living Things in grade 7	1 = yes, 0 = no	32
192	Enrollment in Living Things in grade 8	1 = yes, 0 = no	33
193	Enrollment in Living Things in grade 9	1 = yes, 0 = no	34
194	Enrollment in Living Things in grade 10	1 = yes, 0 = no	35
195	Enrollment in Living Things in grade 11	1 = yes, 0 = no	36
196	Enrollment in Living Things in grade 12	1 = yes, 0 = no	37
197	Use of Modern Biology (Otto)	1 = use 0 = no use	38
198	Enrollment in Otto in grade 7	1 = yes, 0 = no	39
199	Enrollment in Otto in grade 8	1 = yes, 0 = no	40
200	Enrollment in Otto in grade 9	1 = yes, 0 = no	41
201	Enrollment in Otto in grade 10	1 = yes, 0 = no	42
202	Enrollment in Otto in grade 11	1 = yes, 0 = no	43
203	Enrollment in Otto in grade 12	1 = yes, 0 = no	44
204	Other Biology Texts or Courses	1 = yes, 0 = no	45
	Chemistry		
205	Use of Primentel	1 = use 0 = no use	46
206	Enrollment in Primentel in grade 7	1 = yes, 0 = no	47
207	Enrollment in Primentel in grade 8	1 = yes, 0 = no	48
208	Enrollment in Primentel in grade 9	1 = yes, 0 = no	49
209	Enrollment in Primentel in grade 10	1 = yes, 0 = no	50
210	Enrollment in Primentel in grade 11	1 = yes, 0 = no	51
211	Enrollment in Primentel in grade 12	1 = yes, 0 = no	52
212	Use of Cotton	1 = use 0 = no use	53
213	Enrollment in Cotton in grade 7	1 = yes, 0 = no	54
214	Enrollment in Cotton in grade 8	1 = yes, 0 = no	55
215	Enrollment in Cotton in grade 9	1 = yes, 0 = no	56
216	Enrollment in Cotton in grade 10	1 = yes, 0 = no	57

217	Enrollment in Cotton in grade 11	1 = yes, 0 = no	58
218	Enrollment in Cotton in grade 12	1 = yes, 0 = no	59
219	Use of CHEMS	1 = use = no use	60
220	Enrollment in CHEMS in grade 7	1 = yes, 0 = no	61
221	Enrollment in CHEMS in grade 8	1 = yes, 0 = no	62
222	Enrollment in CHEMS in grade 9	1 = yes, 0 = no	63
223	Enrollment in CHEMS in grade 10	1 = yes, 0 = no	64
224	Enrollment in CHEMS in grade 11	1 = yes, 0 = no	65
225	Enrollment in CHEMS in grade 12	1 = yes, 0 = no	66
226	Use of Sienko	1 = use 0 = no use	67
227	Enrollment in Sienko in grade 7	1 = yes, 0 = no	68
228	Enrollment in Sienko in grade 8	1 = yes, 0 = no	69
229	Enrollment in Sienko in grade 9	1 = yes, 0 = no	70
230	Enrollment in Sienko in grade 10	1 = yes, 0 = no	71
231	Enrollment in Sienko in grade 11	1 = yes, 0 = no	72
232	Enrollment in Sienko in grade 12	1 = yes, 0 = no	73
233	Use of IAC	1 = use 0 = no use	74
234	Enrollment in IAC in grade 7	1 = yes, 0 = no	75
235	Enrollment in IAC in grade 8	1 = yes, 0 = no	76
236	Enrollment in IAC in grade 9	1 = yes, 0 = no	77
237	Enrollment in IAC in grade 10	1 = yes, 0 = no	78
Card ID		08 = Card #8	79-80

CARD #9

ID			1-12
		Blank	13
238	Enrollment in IAC in grade 11	1 = yes, 0 = no	14
239	Enrollment in IAC in grade 12	1 = yes, 0 = no	15
240	Use of Modern Chemistry (Metcalfe)	1 = use 0 = no use	16
241	Enrollment in Metcalfe in grade 7	1 = yes, 0 = no	17
242	Enrollment in Metcalfe in grade 8	1 = yes, 0 = no	18
243	Enrollment in Metcalfe in grade 9	1 = yes, 0 = no	19
244	Enrollment in Metcalfe in grade 10	1 = yes, 0 = no	20
245	Enrollment in Metcalfe in grade 11	1 = yes, 0 = no	21
246	Enrollment in Metcalfe in grade 12	1 = yes, 0 = no	22
247	Other Chemistry texts or courses	1 = yes, 0 = no	23

Physics

248	Use of College Physics (Schaum)	1 = use 0 = no use	24
249	Enrollment in College Physics in grade 7	1 = yes, 0 = no	25
250	Enrollment in College Physics in grade 8	1 = yes, 0 = no	26
251	Enrollment in College Physics in grade 9	1 = yes, 0 = no	27
252	Enrollment in College Physics in grade 10	1 = yes, 0 = no	28
253	Enrollment in College Physics in grade 11	1 = yes, 0 = no	29
254	Enrollment in College Physics in grade 12	1 = yes, 0 = no	30
255	Use of Modern Physics (Williams)	1 = use 0 = no use	31
256	Enrollment in Williams in grade 7	1 = yes, 0 = no	32
257	Enrollment in Williams in grade 8	1 = yes, 0 = no	33
258	Enrollment in Williams in grade 9	1 = yes, 0 = no	34
259	Enrollment in Williams in grade 10	1 = yes, 0 = no	35
260	Enrollment in Williams in grade 11	1 = yes, 0 = no	36

261	Enrollment in Williams in grade 12	1 = yes, 0 = no	37
262	Use of PSSC	1 = use 0 = no use	38
263	Enrollment in PSSC in grade 7	1 = yes, 0 = no	39
264	Enrollment in PSSC in grade 8	1 = yes, 0 = no	40
265	Enrollment in PSSC in grade 9	1 = yes, 0 = no	41
266	Enrollment in PSSC in grade 10	1 = yes, 0 = no	42
267	Enrollment in PSSC in grade 11	1 = yes, 0 = no	43
268	Enrollment in PSSC in grade 12	1 = yes, 0 = no	44
269	Use of Project Physics	1 = use 0 = no use	45
270	Enrollment in Project Physics in grade 7	1 = yes, 0 = no	46
271	Enrollment in Project Physics in grade 8	1 = yes, 0 = no	47
272	Enrollment in Project Physics in grade 9	1 = yes, 0 = no	48
273	Enrollment in Project Physics in grade 10	1 = yes, 0 = no	49
274	Enrollment in Project Physics in grade 11	1 = yes, 0 = no	50
275	Enrollment in Project Physics in grade 12	1 = yes, 0 = no	51
276	Other Physics Texts or Courses	1 = yes, 0 = no	52
	Physical Science		
277	Use of Abraham	1 = use 0 = no use	53
278	Enrollment in Abraham in grade 7	1 = yes, 0 = no	54
279	Enrollment in Abraham in grade 8	1 = yes, 0 = no	55
280	Enrollment in Abraham in grade 9	1 = yes, 0 = no	56
281	Enrollment in Abraham in grade 10	1 = yes, 0 = no	57
282	Enrollment in Abraham in grade 11	1 = yes, 0 = no	58
283	Enrollment in Abraham in grade 12	1 = yes, 0 = no	59
284	Use of IPS	1 = use 0 = no use	60
285	Enrollment in IPS in grade 7	1 = yes, 0 = no	61
286	Enrollment in IPS in grade 8	1 = yes, 0 = no	62
287	Enrollment in IPS in grade 9	1 = yes, 0 = no	63
288	Enrollment in IPS in grade 10	1 = yes, 0 = no	64
289	Enrollment in IPS in grade 11	1 = yes, 0 = no	65
290	Enrollment in IPS in grade 12	1 = yes, 0 = no	66
291	Use of Modern Physical Sc (Tracy)	1 = use 0 = no use	67
292	Enrollment in Tracy in grade 7	1 = yes, 0 = no	68
293	Enrollment in Tracy in grade 8	1 = yes, 0 = no	69
294	Enrollment in Tracy in grade 9	1 = yes, 0 = no	70
295	Enrollment in Tracy in grade 10	1 = yes, 0 = no	71
296	Enrollment in Tracy in grade 11	1 = yes, 0 = no	72
297	Enrollment in Tracy in grade 12	1 = yes, 0 = no	73
298	Use of Physical Science II	1 = use 0 = no use	74
299	Enrollment in PS II in grade 7	1 = yes, 0 = no	75
300	Enrollment in PS II in grade 8	1 = yes, 0 = no	76
301	Enrollment in PS II in grade 9	1 = yes, 0 = no	77
302	Enrollment in PS II in grade 10	1 = yes, 0 = no	78
Card ID		09 = Card #9	79-80

Card #10

ID			1-12
		Blank	13
303	Enrollment in PS II in grade 11	1 = yes, 0 = no	14
304	Enrollment in PS II in grade 12	1 = yes, 0 = no	15
305	Use of ECCP	1 = use 0 = no use	16
306	Enrollment in ECCP in grade 7	1 = yes, 0 = no	17
307	Enrollment in ECCP in grade 8	1 = yes, 0 = no	18
308	Enrollment in ECCP in grade 9	1 = yes, 0 = no	19

309	Enrollment in ECCP in grade 10	1 = yes, 0 = no	20
310	Enrollment in ECCP in grade 11	1 = yes, 0 = no	21
311	Enrollment in ECCP in grade 12	1 = yes, 0 = no	22
312	Other	1 = yes, 0 = no	23

Earth Science

313	Use of Namowitz	1 = use 0 = no use	24
314	Enrollment in Namowitz in grade 7	1 = yes, 0 = no	25
315	Enrollment in Namowitz in grade 8	1 = yes, 0 = no	26
316	Enrollment in Namowitz in grade 9	1 = yes, 0 = no	27
317	Enrollment in Namowitz in grade 10	1 = yes, 0 = no	28
318	Enrollment in Namowitz in grade 11	1 = yes, 0 = no	29
319	Enrollment in Namowitz in grade 12	1 = yes, 0 = no	30
320	Use of Bishop	1 = use 0 = no use	31
321	Enrollment in Bishop in grade 7	1 = yes, 0 = no	32
322	Enrollment in Bishop in grade 8	1 = yes, 0 = no	33
323	Enrollment in Bishop in grade 9	1 = yes, 0 = no	34
324	Enrollment in Bishop in grade 10	1 = yes, 0 = no	35
325	Enrollment in Bishop in grade 11	1 = yes, 0 = no	36
326	Enrollment in Bishop in grade 12	1 = yes, 0 = no	37
327	Use of ESCP	1 = use 0 = no use	38
328	Enrollment in ESCP in grade 7	1 = yes, 0 = no	39
329	Enrollment in ESCP in grade 8	1 = yes, 0 = no	40
330	Enrollment in ESCP in grade 9	1 = yes, 0 = no	41
331	Enrollment in ESCP in grade 10	1 = yes, 0 = no	42
332	Enrollment in ESCP in grade 11	1 = yes, 0 = no	43
333	Enrollment in ESCP in grade 12	1 = yes, 0 = no	44
334	Use of Ramsey	1 = use 0 = no use	45
335	Enrollment in Ramsey in grade 7	1 = yes, 0 = no	46
336	Enrollment in Ramsey in grade 8	1 = yes, 0 = no	47
337	Enrollment in Ramsey in grade 9	1 = yes, 0 = no	48
338	Enrollment in Ramsey in grade 10	1 = yes, 0 = no	49
339	Enrollment in Ramsey in grade 11	1 = yes, 0 = no	50
340	Enrollment in Ramsey in grade 12	1 = yes, 0 = no	51
341	Use of TSM	1 = use 0 = no use	52
342	Enrollment in TSM in grade 7	1 = yes, 0 = no	53
343	Enrollment in TSM in grade 8	1 = yes, 0 = no	54
344	Enrollment in TSM in grade 9	1 = yes, 0 = no	55
345	Enrollment in TSM in grade 10	1 = yes, 0 = no	56
346	Enrollment in TSM in grade 11	1 = yes, 0 = no	57
347	Enrollment in TSM in grade 12	1 = yes, 0 = no	58
348	Other Earth Science Texts or Courses	1 = yes, 0 = no	59

Other Courses or Textbooks

349	Use of ISIS	1 = yes, 0 = no	60
350	Enrollment in ISIS in grade 7	1 = yes, 0 = no	61
351	Enrollment in ISIS in grade 8	1 = yes, 0 = no	62
352	Enrollment in ISIS in grade 9	1 = yes, 0 = no	63
353	Enrollment in ISIS in grade 10	1 = yes, 0 = no	64
354	Enrollment in ISIS in grade 11	1 = yes, 0 = no	65
355	Enrollment in ISIS in grade 12	1 = yes, 0 = no	66
356	Use of Blanc	1 = use 0 = no use	67
357	Enrollment in Blanc in grade 7	1 = yes, 0 = no	68
358	Enrollment in Blanc in grade 8	1 = yes, 0 = no	69
359	Enrollment in Blanc in grade 9	1 = yes, 0 = no	70
360	Enrollment in Blanc in grade 10	1 = yes, 0 = no	71
361	Enrollment in Blanc in grade 11	1 = yes, 0 = no	72
362	Enrollment in Blanc in grade 12	1 = yes, 0 = no	73

363	Use of Heimler	1 = use 0 = no use	74
364	Enrollment in Heimler in grade 7	1 = yes, 0 = no	75
365	Enrollment in Heimler in grade 8	1 = yes, 0 = no	76
366	Enrollment in Heimler in grade 9	1 = yes, 0 = no	77
367	Enrollment in Heimler in grade 10	1 = yes, 0 = no	78
Card ID		10 = Card #10	79-80

CARD #11

ID			1-12
		Blank	13
368	Enrollment in Heimler in grade 11	1 = yes, 0 = no	14
369	Enrollment in Heimler in grade 12	1 = yes, 0 = no	15
370	Use of ISCS	1 = use 0 = no use	16
371	Enrollment in ISCS in grade 7	1 = yes, 0 = no	17
372	Enrollment in ISCS in grade 8	1 = yes, 0 = no	18
373	Enrollment in ISCS in grade 9	1 = yes, 0 = no	19
374	Enrollment in ISCS in grade 10	1 = yes, 0 = no	20
375	Enrollment in ISCS in grade 11	1 = yes, 0 = no	21
376	Enrollment in ISCS in grade 12	1 = yes, 0 = no	22
377	Use of Gross	1 = use 0 = no use	23
378	Enrollment in Gross in grade 7	1 = yes, 0 = no	24
379	Enrollment in Gross in grade 8	1 = yes, 0 = no	25
380	Enrollment in Gross in grade 9	1 = yes, 0 = no	26
381	Enrollment in Gross in grade 10	1 = yes, 0 = no	27
382	Enrollment in Gross in grade 11	1 = yes, 0 = no	28
383	Enrollment in Gross in grade 12	1 = yes, 0 = no	29
384	Other Texts of Courses	1 = yes, 0 = no	30
385	Offering a General Science Course	1 = yes, 0 = no	31
386	Using a general science text	1 = use 0 = no use	32
387	Enrollment in general science in grade 7	1 = yes, 0 = no	33
388	Enrollment in general science in grade 8	1 = yes, 0 = no	34
389	Enrollment in general science in grade 9	1 = yes, 0 = no	35
390	Enrollment in general science in grade 10	1 = yes, 0 = no	36
391	Enrollment in general science in grade 11	1 = yes, 0 = no	37
392	Enrollment in general science in grade 12	1 = yes, 0 = no	38
393	Offering specialized courses	1 = yes, 0 = no	39
394	Use of Astronomy	1 = use 0 = no use	40
395	Use of Astronomy Textbook	1 = use 0 = no use	41
396	Enrollment in Astronomy in grade 7	1 = yes, 0 = no	42
397	Enrollment in Astronomy in grade 8	1 = yes, 0 = no	43
398	Enrollment in Astronomy in grade 9	1 = yes, 0 = no	44
399	Enrollment in Astronomy in grade 10	1 = yes, 0 = no	45
400	Enrollment in Astronomy in grade 11	1 = yes, 0 = no	46
401	Enrollment in Astronomy in grade 12	1 = yes, 0 = no	47
402	Use of Physiology	1 = use 0 = no use	48
403	Use Physiology textbooks	1 = yes, 0 = no	49
404	Enrollment in Physiology in grade 7	1 = yes, 0 = no	50
405	Enrollment in Physiology in grade 8	1 = yes, 0 = no	51
406	Enrollment in Physiology in grade 9	1 = yes, 0 = no	52

407	Enrollment in Physiology in grade 10	1 = yes, 0 = no	53
408	Enrollment in Physiology in grade 11	1 = yes, 0 = no	54
409	Enrollment in Physiology in grade 12	1 = yes, 0 = no	55
410	Use of Zoology	1 = use 0 = no use	56
411	Use of Zoology textbooks	1 = use 0 = no use	57
412	Enrollment in Zoology in grade 7	1 = yes, 0 = no	58
413	Enrollment in Zoology in grade 8	1 = yes, 0 = no	59
414	Enrollment in Zoology in grade 9	1 = yes, 0 = no	60
415	Enrollment in Zoology in grade 10	1 = yes, 0 = no	61
416	Enrollment in Zoology in grade 11	1 = yes, 0 = no	62
417	Enrollment in Zoology in grade 12	1 = yes, 0 = no	63
418	Use of Botany	1 = use 0 = no use	64
419	Use of Botany textbooks	1 = use 0 = no use	65
420	Enrollment in Botany in grade 7	1 = yes, 0 = no	66
421	Enrollment in Botany in grade 8	1 = yes, 0 = no	67
422	Enrollment in Botany in grade 9	1 = yes, 0 = no	68
423	Enrollment in Botany in grade 10	1 = yes, 0 = no	69
424	Enrollment in Botany in grade 11	1 = yes, 0 = no	70
425	Enrollment in Botany in grade 12	1 = yes, 0 = no	71
426	Use of Oceanography	1 = use 0 = no use	72
427	Use of Oceanography textbooks	1 = use 0 = no use	73
428	Enrollment in Oceanography in grade 7	1 = yes, 0 = no	74
429	Enrollment in Oceanography in grade 8	1 = yes, 0 = no	75
430	Enrollment in Oceanography in grade 9	1 = yes, 0 = no	76
431	Enrollment in Oceanography in grade 10	1 = yes, 0 = no	77 77
432	Enrollment in Oceanography in grade 11	1 = yes, 0 = no	78
ID		11 = Card #11	79-80

CARD #12

ID			12
		Blank	13
433	Enrollment in Oceanography in grade 12	1 = yes, 0 = no	14
434	Use of Geology	1 = use 0 = no use	15
435	Use of Geology textbooks	1 = use 0 = no use	16
436	Enrollment in Geology in grade 7	1 = yes, 0 = no	17
437	Enrollment in Geology in grade 8	1 = yes, 0 = no	18
438	Enrollment in Geology in grade 9	1 = yes, 0 = no	19
439	Enrollment in Geology in grade 10	1 = yes, 0 = no	20
440	Enrollment in Geology in grade 11	1 = yes, 0 = no	21
441	Enrollment in Geology in grade 12	1 = yes, 0 = no	22
442	Use of Advanced Biology	1 = use 0 = no use	23

443	Use of Advanced Biology textbooks	1 = use 0 = no use	24
444	Enrollment in Advanced Biology in grade 7	1 = yes, 0 = no	25
445	Enrollment in Advanced Biology in grade 8	1 = yes, 0 = no	26
446	Enrollment in Advanced Biology in grade 9	1 = yes, 0 = no	27
447	Enrollment in Advanced Biology in grade 10	1 = yes, 0 = no	28
448	Enrollment in Advanced Biology in grade 11	1 = yes, 0 = no	29
449	Enrollment in Advanced Biology in grade 12	1 = yes, 0 = no	30
450	Use of Advanced Chemistry	1 = use 0 = no use	31
451	Use of Advanced Chemistry textbooks	1 = use 0 = no use	32
452	Enrollment in Advanced Chemistry in grade 7	1 = yes, 0 = no	33
453	Enrollment in Advanced Chemistry in grade 8	1 = yes, 0 = no	34
454	Enrollment in Advanced Chemistry in grade 9	1 = yes, 0 = no	35
455	Enrollment in Advanced Chemistry in grade 10	1 = yes, 0 = no	36
456	Enrollment in Advanced Chemistry in grade 11	1 = yes, 0 = no	37
457	Enrollment in Advanced Chemistry in grade 12	1 = yes, 0 = no	38
458	Use of Advanced Physics	1 = use 0 = no use	39
459	Use of Advanced Physics textbooks	1 = use 0 = no use	40
460	Enrollment in Advanced Physics in grade 7	1 = yes, 0 = no	41
461	Enrollment in Advanced Physics in grade 8	1 = yes, 0 = no	42
462	Enrollment in Advanced Physics in grade 9	1 = yes, 0 = no	43
463	Enrollment in Advanced Physics in grade 10	1 = yes, 0 = no	44
464	Enrollment in Advanced Physics in grade 11	1 = yes, 0 = no	45
465	Enrollment in Advanced Physics in grade 12	1 = yes, 0 = no	46
466	Use of Honors Science Program	1 = use 0 = no use	47
467	Use of HSP textbooks	1 = use 0 = no use	48
468	Enrollment in HSP in grade 7	1 = yes, 0 = no	49
469	Enrollment in HSP in grade 8	1 = yes, 0 = no	50
470	Enrollment in HSP in grade 9	1 = yes, 0 = no	51
471	Enrollment in HSP in grade 10	1 = yes, 0 = no	52
472	Enrollment in HSP in grade 11	1 = yes, 0 = no	53
473	Enrollment in HSP in grade 12	1 = yes, 0 = no	54
474	Other Programs	1 = yes, 0 = no	55
475	Teaching separate science courses for below average students	1 = yes, 0 = no	56
476	Teaching separate science courses for gifted students	1 = yes, 0 = no	57
477	Teacher's view of teaching spearate science courses for below average students	1 = yes, 0 = no	58
478	Teacher's view of teaching separate science courses for gifted students	1 = yes, 0 = no	59
	Teacher's view of the need of assistance in the following:		
479	Obtaining information about recent curriculum development	1 = yes, 0 = no	60

480	Obtaining information about new teaching methods	1 = yes, 0 = no	61
481	Obtaining information about instructional materials	1 = yes, 0 = no	62
482	Obtaining information about subject matter	1 = yes, 0 = no	63
483	Obtaining information about out-of-school resources	1 = yes, 0 = no	64
484	Obtaining information about films, TV, and radio programs	1 = yes, 0 = no	65
485	Implementing new curriculum projects	1 = yes, 0 = no	66
486	Developing local curriculum materials	1 = yes, 0 = no	67
487	Implementing discovery approach	1 = yes, 0 = no	68
488	Articulating instruction	1 = yes, 0 = no	69
489	Using manipulative materials	1 = yes, 0 = no	70
490	Developing skills to use science equipment	1 = yes, 0 = no	71
491	Developing skills to use audiovisual aids	1 = yes, 0 = no	72
492	Other	1 = yes, 0 = no	73
493	Teacher's view of the need for more inservice training	1 = yes, 0 = no	74
494	Inservice opportunities in science content	1 = yes, 0 = no	75
495	Inservice opportunities in change strategies	1 = yes, 0 = no	76
496	Inservice opportunities in evaluation strategies	1 = yes, 0 = no	77
497	Inservice opportunities in science teaching techniques	1 = yes, 0 = no	78
Card ID		12 = Card #12	79-80

CARD #13

ID			1-12
		Blank	13
498	Other inservice opportunities		14

V. Learning Activities

Teacher's ranking of the following learning activities.

499	Group laboratory activity	3 = Most often used 2 = Second most 1 = Third most 0 = Not used	15
500	Individual lab activity		16
501	Science demonstration		17
502	Auto-tutorial instruction		18
503	Programmed instruction		19
504	Televised instruction		20
505	Instructional films		21
506	Excursions		22
507	Lecture		23
508	Lecture-Discussion		24
509	Small group discussion		25
510	Independent studies		26
511	Library work		27
512	In-class written assignments		28
513	Guest speakers		29
514	Other learning activities	1 = yes, 0 = no	30

VI. Change

515	Working in school	1 = yes, 0 = no	31
516	Changes in science programs	1 = yes, 0 = no	32
517	Revised courses	1 = yes, 0 = no	33
518	Added courses	1 = yes, 0 = no	34
519	Eliminated courses	1 = yes, 0 = no	35
520	Changed textbooks	1 = yes, 0 = no	36

521	Developed new materials	1 = yes, 0 = no	37
522	Reduced student requirements	1 = yes, 0 = no	38
523	Increased student requirements	1 = yes, 0 = no	39
524	Other	1 = yes, 0 = no	40
525	Teacher's view of reasons for change	1 = yes, 0 = no	41
526	Teacher's satisfaction with science program	5 = Very Satisfied 4 = Satisfied 3 = Neutral 2 = Dissatisfied 1 = Very Dissatisfied	
527	Teacher's view of change	1 = yes, 0 = no	43
		Blank	44-78
Card ID		13 = Card #13	79-80

Variables of Principal and Teacher Attitude Questionnaire (Q:AP) & (Q:AT)

CARD #1

Variable #'s	Variable	Coding	Column #
ID	Level	1 = Elem 2 = Sec	1
	Respondent	1 = T 2 = P	2
	Region	1 = GL, 2 = FW 3 = NE, 4 = ME 5 = SW, 6 = RM 7 = P, 8 = SE	3
	State		4-5
	County		6-8
	School		9-11
	Respondent #	1-2 = P 1-6 = T	12
		Blank	13

I. Decision Making:

Variable #'s	Variable	Coding	Column #
1	Respondent's influence (has)	3 = Considerable 2 = Some 1 = None	14
	Influence each of the following has:		
2	State Department of Ed		15
3	District Superintendent		16
4	Central Staff		17
5	School Board		18
6	Principal		19
7	Department Chairman		20
8	Teachers		21
9	Students		22
10	Parents		23
11	Other	1 = yes, 0 = no	24
12	Respondent's Influence (should have)	3 = C, 2 = S 1 = N	25
	Influence each of the following should have	3 = C, 2 = S 1 = N	
13	State Dept of Ed		26
14	District Superintendent		27
15	Central Staff		28
16	School Board		29
17	Principal		30
18	Department Chairman		31
19	Teachers		32
20	Students		33
21	Parents		34
22	Other	1 = yes, 0 = no	35

II. Changes in Science Curriculum and Instruction

Variable #'s	Variable	Coding	Column #
23	Respondent's attitude toward new materials	5 = Very positive 4 = Positive 3 = Neutral 2 = Negative 1 = Very Negative	36

Attitude of each of the following toward new materials

24	State Dep of Ed	5 = Very Positive 4 = Positive 3 = Neutral 2 = Negative 1 = Very Negative	37
25	District Superintendent		38
26	Central Staff		39
27	School Board		40
28	Principal		41
29	Department Chairman		42
30	Teachers		43
31	Students		44
32	Parents		45
33	Others	1 = yes, 0 = no	46

III. Resources

Respondent's opinion of what should be spent from:

34	Local funds	5 = Much More 4 = More 3 = Same 2 = Less 1 = Much Less	47
35	State funds		48
36	Federal funds		49
37	Respondent's opinion of needed science equipment and supplies	3 = Much More 2 = Somewhat More 1 = No More	50

Respondent's opinion of the degree of usefulness of information about new materials from each of the following:

A. Person-to-person Communication Contact with Building:

38	Teachers	3 = Very Useful 2 = Useful 1 = Not Useful	51
39	Principal		52

School District

40	Teachers		53
41	Principal		54
42	Curriculum specialists		55
43	Other professionals		56
44	Other	1 = yes, 0 = no	57

Outside School District

45	Teachers	3 = VU, 2 = U 1 = NU	58
46	Principals		59
47	State department personnel		60
48	Curriculum specialists		61
49	Textbooks		62
50	College professors		63
51	Science materials developers		64
52	Other	1 = yes, 0 = no	65

	B. Printed Communication		
53	Professional Periodicals	3 = VU, 2 = U 1 = NU	66
54	Textbooks		67
55	Bulletins		68
56	Others	1 = yes, 0 = no	69
	C. Formal Courses and Inservice Education		
	Formal Courses		
57	Regular college courses	3 = VU, 2 = U 1 = NU	70
58	Special college courses		71
	Inservice Programs		
59	Local inservice		72
60	County inservice		73
61	State inservice		74
62	NSF inservice		75
63	Others	1 = yes, 0 = no	76
	D. Mass Media		
	TV		
64	Public TV	3 = VU, 2 = U 1 = NU	77
65	Commercial TV		78
Card ID		01 = CARD #1	79-80

CARD #2

ID			1-12
	Radio		
66	Public Radio	3 = VU, 2 = U 1 = NU	14
67	Commercial Radio		15
68	Newspapers		16
69	General Magazines		17
70	Others	1 = yes, 0 = no	18
	E. Meetings of Professional Organizations		
71	Local organizations	3 = VU, 2 = U 1 = NU	19
72	State organizations		20
73	National organizations		21
74	Others	1 = yes, 0 = no	22
	Respondent's opinion of the degree of usefulness of the following types of information:		
75	A. Information about Curriculum	3 = VU, 2 = U 1 = NU	23
76	NSF materials		24
77	State curriculum guides		25
78	Locally developed materials		26
79	Implementation strategies		27
80	Supplementary activities		28
81	Philosophy of curriculum		29
82	Others	1 = yes, 0 = no	30
83	B. Information about Instruction	3 = VU, 2 = U 1 = NU	31
84	Teaching techniques		32
85	Laboratory techniques		33
86	Individualized instruction		34
87	Televised instruction		

88	Audiovisual instruction		36
89	Others	1 = yes, 0 = no	37
90	C. Information about Classroom	3 = VU, 2 = U 1 = NU	38
91	Student's behavior		39
92	Classroom management		40
93	D. Information about Evaluation		41
94	Information about policies		42
95	Information about budget		43
96	Information about county		44
97	Others	1 = yes, 0 = no	45
	Respondent's opinion about how soon the following types of information are needed:		
98	A. Information about Curriculum	4 = Within 48 hours 3 = Within a week 2 = Within one month 1 = Within six months	46
99	NSF materials		47
100	State curriculum guides		48
101	Local developed materials		49
102	Implementation strategies		50
103	Supplementary activities		51
104	Philosophy of curriculum		52
105	Others	1 = yes, 0 = no	53
106	B. Information about Instructions	4 = 48 hours 3 = a week 2 = one month 1 = six months	54
107	Teaching techniques		55
108	Laboratory techniques		56
109	Individualized instruction		57
110	Televised instruction		58
111	Audiovisual instruction		59
112	Others	1 = yes, 0 = no	60
113	C. Information about classroom	4 = 48 hours 3 = a week 2 = one month 1 = six months	61
114	Students' behavior		62
115	Classroom management		63
116	Information about evaluation		64
117	Information about Policies		65
118	Information about Budget		66
119	Information about Court		67
120	Others	1 = yes, 0 = no	68
IV.	Federal Support for Curriculum Development		
	Respondent's degree of agreement of the following about federal support for science course improvement		
121	Improved the quality of curriculum alternatives	5 = Strongly Agree 4 = Agree 3 = Neutral 2 = Disagree 1 = Strongly Disagree	69

122	Improved classroom instruction	5 = SA, 4 = A 3 = N, 2 = D 1 = SD	70
123	Disseminate materials		71
124	Federal support is unnecessary		72
125	Create a nationally uniform curriculum		73
126	Support for NSF materials		74
127	Support for non-NSF materials		75
128	Purchase of lab equipment		76
129	Knowledge of reduction of NSF funds	1 = Know 0 = Don't know	77
130	Respondent's opinion of the effect of reducing NSF funds	5 = Very Positive 4 = Positive 3 = Neutral 2 = Negative 1 = Very Negative 0 = Don't Know	78
Card ID		02 = Card #2	79-80

CARD #3

ID			1-12

V. Science Programs

Respondent's opinion of the importance of the following for the secondary schools since programs:

131	Factual knowledge	3 = Very Important 2 = Important 1 = Not Important	14
132	Processes of science		15
133	Interaction of science and society		16
134	Interaction of science and technology		17
135	Values and ethics of science		18
136	Appreciation of human endeavor		19
137	Attitudes		20
138	Science and humanities		21
139	Career		22
140	Skills		23
141	Nature of science		24
142	Self and environment		25

VI. Barriers to Change

Respondent's opinion of the effect of the following factors on science programs:

143	Lack of inservice opportunities	3 = Serious problem 2 = Somewhat 1 = Not a problem	26
144	Lack of consultant services		27
145	Inadequate facilities		28
146	Lack of science equipment		29
147	Lack of individualized materials		30
148	Insufficient budget		31
149	Costs of curriculum materials		32
150	Out-of-date materials		33
151	No agreement about curriculum		34
152	Low priority of science		35
153	Inadequate reading ability		36

154	Inadequate math background		37
155	Low enrollment		38
156	Inadequate articulation within a building		39
157	Inadequate articulation within a district		40
158	Teachers inadequately prepared		41
159	Lack of teacher planning		42
160	Lack of interest		43
161	Lack of federal support		44
162	Lack of state support		45
163	Lack of local support		46
164	Lack of administrative support		47
165	Lack of community support		48
166	Lack of staff support		49
167	State regulations		50
168	Federal regulations		51
169	Lack of communication		52
170	Lack of consultants		53
171	Lack of tangible incentives		54
172	Lack of intangible incentives		55
173	Emphasis on basic skills		56
174	Lack of laboratory assistants		57
175	Others	1 = yes, 0 = no	58
	Respondent's opinion of the importance of the following tangible incentives:		
176	Extra pay	3 = First most important 2 = Second most important 1 = Third most important 0 = Not used	59
177	Salary differential		60
178	College credit		61
179	Released time		62
180	Travel funds		63
181	Participating in workshops		64
182	Promotion		65
183	Others	1 = yes, 0 = no	66
	Respondent's opinion of the importance of the following intangible incentives:		
184	Recognition	3 = First most important 2 = Second most important 1 = Third most important 0 = Not used	67
185	Pursue beliefs		68
186	Pursue new ideas		69
187	Desire to know		70
188	Escape from boredom		71
189	Professional interest		72
190	Intrinisic satisfaction		73
191	Development of group affiliation		74
192	Increase sense		75
193	Solution to students needs		76
194	Others	1 = yes, 0 = no	77
	Respondent's opinion of the type of science curricula being prefered		
195	A textbook with little modification	1 = yes, 0 = no	78
Card ID		03 = Card #3	79-80

CARD 4

ID			1-12
196	A textbook with supplementary materials	1 = yes, 0 = no	14
197	Several textbooks	1 = yes, 0 = no	15
198	Teacher developed materials	1 = yes, 0 = no	16
199	Others	1 = yes, 0 = no	17
		Blank	18,19

CAST

Respondent's perception of the type of activity that takes place in science classroom

	A. Students Activities		
200	Does take place	5 = 1, 4 = b 3 = c, 2 = d 1 = e	21
201	Should take place		22
	B. Teacher's Role		
202	Does take place		23
203	Should take place		24
	C. Textbook		
204	Does take place		25
205	Should take place		26
	D. Tests		
206	Does take place		27
207	Should take place		28
	E. Laboratory		
208	Does take place		29
209	Should take place		30
		Blank	31-40
210	Return Date	Week # (01-30)	41-42
		Blank	42-78
ID Card		04 = Card #	79-80

APPENDIX D

(1) Letters used for the States of which the State Science Supervisor gave approval to be involved in the study

Letter to State Science Supervisors

Form of Approval to participate in the study from the State Science Supervisor

Letter to principals

Letter to Science Teachers

Study Description

Science Teacher Selection Criteria

(2) Letters used for the State of which the state science supervisor did not agree to be involved in the study

First letter to principals

Form of Approval to participate in the study from the principal

Second letter to principals

Letters to teachers

(3) Follow-up Letters

Follow-up letter to principal

Follow-up forms to be completed by principals

Sketch

Letters to State Science Supervisors

Dear State Science Supervisor:

During the 1950's and 1960's substantial emphasis was placed on improvement of science teaching and learning in secondary schools. Recognizing the need for identifying science teaching conditions in public schools, The Ohio State University (OSU) conducted a National Survey of Secondary Schools in the early 70's and smaller surveys after that time.

A study is being conducted by the SMEAC Information Reference Center of OSU to identify changes that have occurred in science programs and practices from 1970-71 to 1979-80 and identify some variables related to state control of education, state financial support and teachers' and principals' attitudes toward the change process. Your state was included in the 1970-71 study and selected for this study. Your participation in this study is highly appreciated and will provide useful information regarding the process of change in schools, the selection of instructional materials and the development of science curricula.

Your willingness to participate in this study is appreciated. Enclosed are: (1) a description of the study; (2) the state science supervisor questionnaire, please complete and return in the enclosed self-addressed envelope by   or as soon as convenient; (3) a set of teachers' and principals' questionnaires for your information; (4) a list of the selected schools in your state; (5) packages of materials for each of the selected schools; and (6) copies of reports from one of the previous surveys.

Please mail them to the schools. Directions are provided with each package for the selected schools. Principals and teachers are requested to mail all the completed questionnaires directly to us [illegible] as soon as convenient.

All the information collected from these questionnaires will be kept confidential. [illegible]

The success of the study depends on your cooperation and in completing the instruments to the best of your ability. We are sure that your cooperation in this project will provide data of interest to both administrators and teachers as well as to curriculum developers.

A copy of one of the previous reports is enclosed for your review. Each school participating in this study will get a summary of this study also.

Please feel free to call or write if you desire clarification of any aspect of this study.

Again, we wish to express our gratitude to you for your cooperation. Thank you.

Sincerely,

Robert W. Howe

Robert W. Howe,
Director of SMEAC
Professor of Science Education

Hussein B. Mahmoud

Hussein B. Mahmoud
Graduate Research Associate

Enclosure

THE OHIO STATE UNIVERSITY

Dear State Science Supervisor:

Please indicate whether you will be involved in sending the materials to the selected schools in your state. Please complete this form and return by ______________ or call collect (614) 422-6717 (ERIC Center). The self-addressed, stamped envelope is enclosed for your convenience. An early response will be greatly appreciated.

I'm willing to be involved in this study.

_____ Yes

_____ No

Thank you.

Return to:

Hussein Bashir Mahmoud
Graduate Research Associate
SMEAC Information Reference Center
1200 Chambers Road - Room 310
Columbus, Ohio 43212

Dear Principal:

During the 1950's and 1960's substantial emphasis was placed on the improvement of science teaching and learning in secondary schools. Recognizing the need for identifying science teaching conditions in public schools, The Ohio State University (OSU) conducted a National Survey of Secondary Schools in the early 70's and smaller surveys after that time.

A study is being conducted by the SMEAC Information Reference Center of OSU to identify changes that have occurred in science programs and practices from 1970-71 to 1979-80 and identify some variables related to state control of education, state financial support and teachers' and principals' attitudes toward the change process. Your school was included in the 1970-71 study and selected for this study. Your participation in this study is highly appreciated and will provide useful information regarding the process of change in schools, the selection of instructional materials and the development of science curricula.

Enclosed are:

(1) A description of the study.

(2) A package of materials which contains:

  a. [illegible]
  b. [illegible]

(3) [illegible]

[illegible]

(1) [illegible]

(2) [illegible]

(3) [illegible]

All the information collected from these questionnaires will be kept confidential. No names and other identifications for schools and individuals responding to questionnaires will be released in the final report.

The success of the study depends on your cooperation. We are sure that your cooperation in this project will provide data of interest to both administrators and teachers as well as curriculum developers.

Please feel free to call or write if you desire clarification of any aspects of this study.

Again, we wish to express our gratitude to you for your cooperation. Thanks.

Sincerely,

Robert W. Howe
Robert W. Howe
Director of SMEAC
Professor of Science Education

Hussein Badi Mahmoud
Hussein B. Mahmoud
Graduate Research Associate

OSU

The Ohio State University

Academic Faculty
of Science and
Mathematics Education

283 Arps Hall
1945 North High Street
Columbus, Ohio 43210

Phone 614 422-4121

Dear Teacher:

During the 1950's and 1960's substantial emphasis was placed on the improvement of science teaching and learning in secondary schools. Recognizing the need for identifying science teaching conditions in public schools, The Ohio State University (OSU) conducted a National Survey of Secondary Schools in the early 70's and smaller surveys after that time.

A study is being conducted by the SMEAC Information Reference Center of OSU to identify changes that have occurred in science programs and practices from 1970-71 to 1979-80 and identify some variables related to state control of education, state financial support and teachers' and principals' attitudes toward the change process. Your school was included in the 1970-71 study and selected for this study. Your participation in this study is highly appreciated and will provide useful information regarding the process of change in schools, the selection of instructional materials and the development of science curricula. Enclosed are: (1) a description of the study and (2) three instruments to be completed by you.

We are requesting you to complete these instruments and return them directly to us in the enclosed self-addressed stamped envelope by   or as soon as convenient.

All the information collected from these questionnaires will be kept confidential. No names or other identification for schools and individuals responding to the questionnaires will be released in the final report.

The success of the study depends on your cooperation and on completing the instruments to the best of your ability. We are sure that your cooperation in this project will provide data of interest to both administrators and teachers as well as curriculum developers.

A copy of a previous study has been sent to your principal. A summary of this study will be sent to your school also. The principal of your school has been contacted and formal approval for conducting this study has been given by the school administration.

Please feel free to call or write if you desire clarification of any aspects of this study.

Again, we wish to express our gratitude to you for your cooperation. Thank you!

Sincerely,

Robert W. Howe
Robert W. Howe
Director of SMEAC
Professor of Science Education

Hussein Bashir Mahmoud
Hussein B. Mahmoud
Graduate Research Associate

Enclosures
RWH:HBM:lss

College of Education

Study Description

Following is a description of the study to provide information concerning state science supervisor (consultant), principal and teacher participation.

I. Size of the Study:

The target population of this study consists of public secondary schools (grades 7-12) which participated in the 1970-71 OSU study and in which both the principal and the teacher(s) responded. Ten states were selected according to certain criteria. Ten schools were selected randomly for each state. The principal of each of the sampled schools and three science teachers are requested to participate in this study. Science supervisors (consultant) of the selected states are also requested to participate.

II. State Science Supervisor (Consultant) Participation:

The state science supervisors participating in this study are requested to complete one questionnaire, and mail packages of materials to the selected schools in each state. (Supervisors may not mail materials in all states.)

III. Principal and Teacher Participation:

The principal of each of the sampled schools will be requested to select randomly three science teachers to participate in the study., Science teachers and principals are requested to complete two questionnaires and one checklist. The first questionnaire is concerned with the states of science teaching in the current 1979-80 school year. The second questionnaire deals with attitudes toward changes in science programs and practices. The Checklist for Assessment for Science Teacher (CAST) will be used to measure principals' and teachers' perceptions of what usually takes place or should take place in the science classroom. The instruments used are listed below. The approximate times for completing each instrument are given in parentheses.

Principal Data:

1. Status of Science Teaching Public Secondary Schools in 1979-80 school year. Principal Questionnaire (25-45 minutes)
2. Attitudes toward Science Curriculum and Instruction. Principal Questionnaire (20-30 minutes)
3. Checklist for Assessment of Science Teacher (CAST:PP). Principal's Perception (15-25 minutes)

Teacher Data:

1. Status of Science Teaching in Public Secondary Schools in 1979-80 school year. Science Teacher Questionnaire (25-45 minutes)
2. Attitudes toward Science Curriculum and Instruction. Teacher Questionnaire (20-30 minutes)
3. Checklist for Assessment of Science Teacher (CAST:TP). Teacher's Perception (15-25 minutes)

Principals and teachers are requested to return their completed questionnaires in the enclosed self-addressed stamped envelope.

The names and other identification of state supervisor, principals, teachers and schools will be kept confidential. All information will be treated in a professional matter.

Science Teacher Selection Criteria

We request your cooperation in randomly selecting three science teachers on your staff to participate in this study. The method of selecting these teachers is as follows:

1. List the names of all science teachers who teach at least two science courses or subjects (at least 30% of their time) in any grade level or a combination of grade levels in your school. Please do not include in your selection any science teacher who has started working only this fall (1979) in your school.

2. Select your science teachers according to the following criteria: If the total number of science teachers in your school is:

    a. Less than or equal to 3, select all of them.

    b. Greater than 3, please write the number for each science teacher on a piece of paper. Put all these papers (which have to be of equal size) in a container. Pick three papers and select the three science teachers on your list with these numbers.

Example:

1. If you have 10 teachers and you picked papers with numbers 2, 5, 7 select teachers with numbers 2, 5, 7 on your list.

2. If you have 5 teachers and you picked papers with numbers 1, 2, 5 select teachers with numbers 1, 2, 5 on your list.

OSU

The Ohio State University

ERIC Clearinghouse for Science, Mathematics and Environmental Education
Room 310
1200 Chambers Road
Columbus, Ohio 43212
Phone 614 422-6717

Dear Principal:

During the 1950's and 1960's substantial emphasis was placed on the improvement of science teaching and learning in secondary schools. Recognizing the need for identifying science teaching conditions in public schools, The Ohio State University (OSU) conducted a national Survey of Secondary Schools in the early 70's and smaller surveys after that time.

A study is being conducted by the SMEAC Information Reference Center of OSU to identify changes that have occurred in science programs and practices from 1970-71 to 1979-80 and identify some variables related to state control of education, state financial support and teachers' and principals' attitudes toward the change process. Your school was included in the 1970-71 study and selected for this study. Your participation in this study which is voluntary is highly appreciated and will provide useful information regarding the process of change in schools, the selection of instructional materials and the development of science curricula.

Your willingness to participate in this study is appreciated. Enclosed for your review is a sample of material which contains:

1. A description of the study
2. A set of the principals' instruments (three questionnaires).
3. A set of the teachers' instruments (three questionnaires). A letter and a description of the study are attached to each set of instruments for each teacher.
4. Procedures for selecting three science teachers on your staff
5. A copy of reports from one of the previous studies.

Please feel free to call or write if you desire clarification of any aspect of this study.

All the information collected from these questionnaires will be kept confidential. No names or other identification for schools and individuals responding to questionnaires will be released in the final report.

Each school participating in this study will get a summary of this study.

The success of the study depends on your cooperation. We are sure that your cooperation in this project will provide data of interest to both administrators and teachers as well as to curriculum developers.

Please complete this form and return by or call collect (614) 422-6717 (ERIC Center). The self-addressed, stamped envelope is enclosed for your convenience. An early response will be greatly appreciated.

Again, we wish to express our gratitude to you for your cooperation. Thank you.

Sincerely,

Robert W. Howe

Robert W. Howe
Director of SMEAC
Professor of Science Education

Hussein Bashi Mahmoud

Hussein B. Mahmoud
Graduate Research Associate

Name ______________________________

School ______________________________

School Address ______________________________

____

Please complete the following information and return by
or as soon as convenient.

We are willing to participate in this study. _______ Yes

_______ No

Any questions or comments? ______________________________

____

____

Thank you!

Please return Format To:

Hussein Bashir Mahmoud
Graduate Research Associate
SMEAC Information Reference Center
1200 Chambers Road, Room 310
Columbus, OH 43212
Phone: (614) 422-6717

OSU

The Ohio State University

Academic Faculty
of Science and
Mathematics Education

283 Arps Hall
1945 North High Street
Columbus, Ohio 43210

Phone 614 422-4121

Dear Principal:

Thank you for allowing us to conduct The Ohio State University (OSU) study in your school. Your participation in this study is highly appreciated and will provide useful information regarding the process of change in schools, the selection of instructional materials and the development of science curricula.

Enclosed are:

(1) A description of the study.

(2) A package of materials which contains:

  a. Three instruments to be completed by you.
  b. Three instruments to be completed by each of the selected science teachers. A letter and a description of the study are attached to each set of instruments for each teacher.

(3) Procedures for selecting three science teachers.

We are requesting you to:

(1) Randomly select three science teachers on your staff.

(2) Give each selected science teacher a set of the teachers' instruments and a self-addressed stamped envelope.

(3) Complete the principal instruments and return directly to us in the enclosed self-addressed stamped envelope by   or as soon as convenient.

All the information collected from these questionnaires will be kept confidential. No names or other identification for schools and individuals responding to the questionnaires will be released in the final report.

The success of the study depends on your cooperation on completing the instruments to the best of your ability. We are sure that your cooperation in this project will provide data of interest to both administrators and teachers as well as to curriculum developers. Each school participating in this study will get a summary of this study also.

Please feel free to call or write if you desire clarification of any aspect of this study.

Again, we wish to express our gratitude to you for your cooperation. Thank you!

Sincerely,

Robert W. Howe
Robert W. Howe
Director of SMEAC
Professor of Science Education

Hussein Bashi Mahmoud
Hussein B. Mahmoud
Graduate Research Associate

College of Education

THE OHIO STATE UNIVERSITY

Dear Teacher:

During the 1950's and 1960's substantial emphasis was placed on the improvement of science teaching and learning in secondary schools. Recognizing the need for identifying science teaching conditions in public schools, The Ohio State University (OSU) conducted a National Survey of Secondary Schools in the early 70's and smaller surveys after that time.

A study is being conducted by the SMEAC Information Reference Center of OSU to identify changes that have occurred in science programs and practices from 1970-71 to 1979-80 and identify some variables related to state control of education, state financial support and teachers' and principals' attitudes toward the change process. Your school was included in the 1970-71 study and selected for this study. Your participation in this study is highly appreciated and will provide useful information regarding the process of change in schools, the selection of instructional materials and the development of science curricula.

Enclosed are--

(1) A description of the study.

(2) Three instruments to be completed by you.

We are requesting you to complete these instruments and return them directly to us in the enclosed self-addressed stamped envelope by
or as soon as convenient.

All the information collected from these questionnaires will be kept confidential. No names or other identification for schools and individuals responding to questionnaires will be released in the final report.

The success of the study depends on your cooperation and on completing the instruments to the best of your ability. We are sure that your cooperation in this project will provide data of interest to both administrators and teachers as well as curriculum developers.

A copy of a previous study has been sent to your principal. A summary of this study will be sent to your school also.

Please feel free to call or write if you desire clarification of any aspects of this study.

Again, we wish to express our gratitude to you for your cooperation. Thank you.

Sincerely,

Robert W. Howe
Robert W. Howe
Director of SMEAC
Professor of Science Education

Hussein Bashir Mahmoud
Hussein B. Mahmoud
Graduate Research Associate

OSU

The Ohio State University

ERIC® Clearinghouse for Science, Mathematics and Environmental Education

Room 310
1200 Chambers Road
Columbus, Ohio 43212
Phone 614 422-6717

Dear Principal:

Materials for the study of science teaching in secondary schools have been distributed to you. Included were four (4) sets of instruments to be completed by each of the three selected science teachers on your staff, and one to be completed by you (or your staff). We have received the responses from:

Principal (P)	Teacher #1 (T1)	Teacher #2 (T2)	Teacher #3 (T3)
☐	☐	☐	☐

We need your assistance to obtain a good response for the success of this study. Please check the boxes on the enclosed form for each respondent, and return the form in the enclosed self-addressed stamped envelope by or as soon as convenient.

Please feel free to call collect (614) 422-6717 (ERIC Center) or write if you desire clarification of any aspects of this study.

Again, we wish to express our gratitude to you for your cooperation. Thank you.

Sincerely,

Robert W. Howe
Robert W. Howe
Director of SMEAC
Professor of Science
Education

Hussein B. Mahmoud
Hussein Bashir Mahmoud
Graduate Research Associate

Enclosure

dmw

College of Education
Academic Faculty of Science-Mathematics Education

SMEAC/INFORMATION REFERENCE CENTER
THE OHIO STATE UNIVERSITY

STUDY OF SCIENCE TEACHING IN PUBLIC SECONDARY SCHOOLS (1979/1980)

Name of School ____________________________________

Address of School ____________________________________
Number Street

____
City State Zip Code

PLEASE CHECK THE APPROPRIATE BOX FOR EACH RESPONDENT:

P	T1	T2	T3	
☐	☐	☐	☐	Questionnaires have been returned to OSU.
☐	☐	☐	☐	Questionnaires will be completed and mailed about ______________________.
☐	☐	☐	☐	Questionnaires have been received, but we are unable to participate in this Study.
☐	☐	☐	☐	Questionnaires have not been received or have been lost. Please send another set.

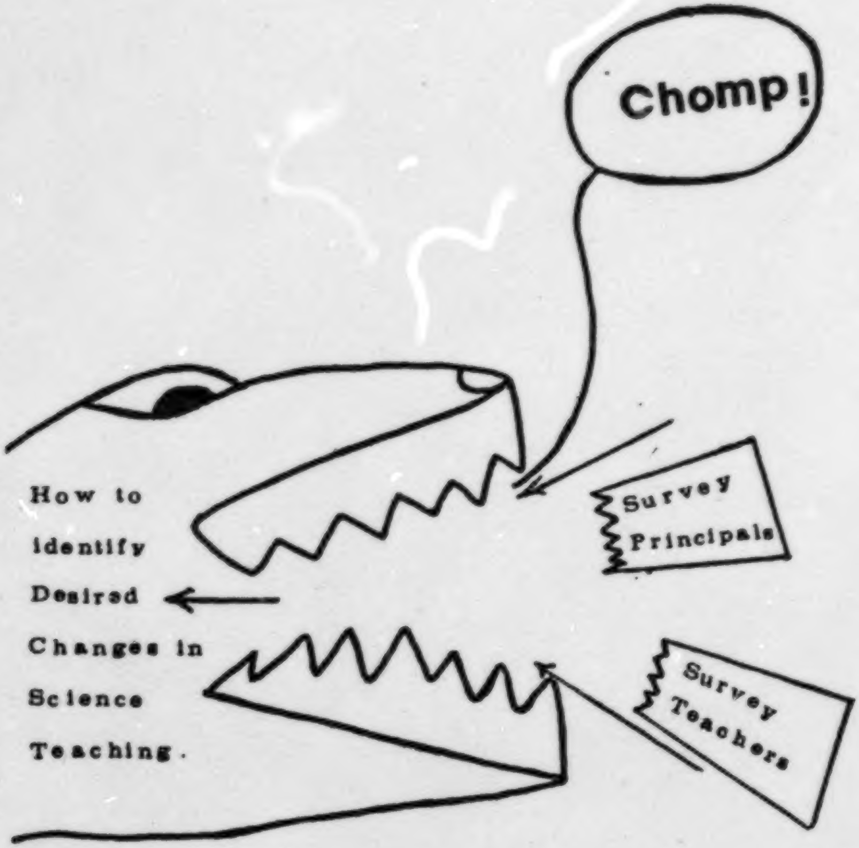
Comments: ______________________________

____

Thank you!

Please Return Answer Sheet To:

Hussein Bashir Mahmoud, Graduate Research Associate
SMEAC Information Reference Center
1200 Chambers Road, Room 310
Columbus, OH 43212
Phone: (614) 422-6717


Chomp!
How to identify Desired Changes in Science Teaching.
Survey Principals
Survey Teachers

Help by returning your "CARE" package.

OSU

The Ohio State University

ERIC® Clearinghouse for Science, Mathematics and Environmental Education
Room 310
1200 Chambers Road
Columbus, Ohio 43212
Phone 614 422-6717

Dear State Science Supervisor:

We wish again to express our gratitude to you for your cooperation and helping in the distribution of the questionnaires of the OSU Secondary School Study. Enclosed is a list of the principals and teachers who returned their questionnaires to us.

We need your assistance to obtain a good response for the success of this study. Please help us to have all completed questionnaires by
or as soon as convenient.

Again, we wish to express our gratitude to you for your cooperation.

Thanks again.

Sincerely,

Robert W. Howe
Robert W. Howe
Director of SMEAC
Professor of Science
Education

Hussein Bashir Mahmoud
Hussein Bashir Mahmoud
Graduate Research Associate

Enclosure

dsw

College of Education
Academic Faculty of Science-Mathematics Education

APPENDIX E

Scattergram Diagrams

(Figures A.1 through A.21)

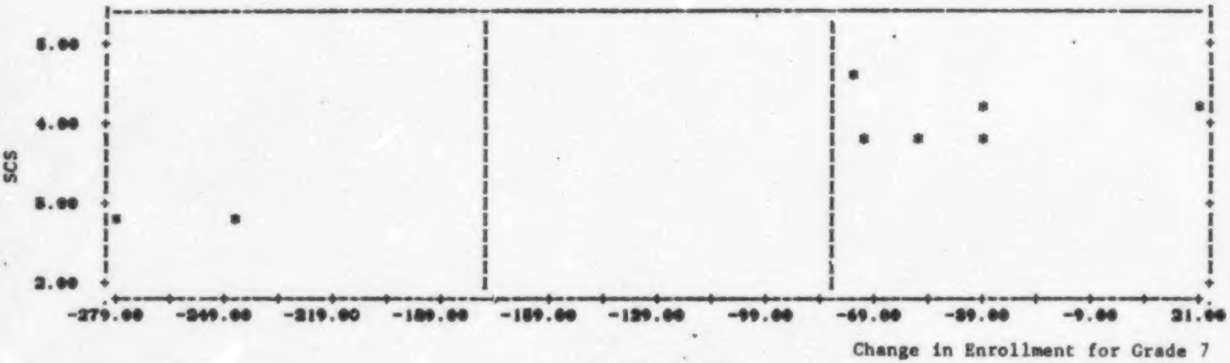


FIGURE A.1

SCATTERGRAM OF STATE CENTRALIZATION SCORES(SCS) ACROSS CHANGE IN ENROLLMENT FOR GRADE 7

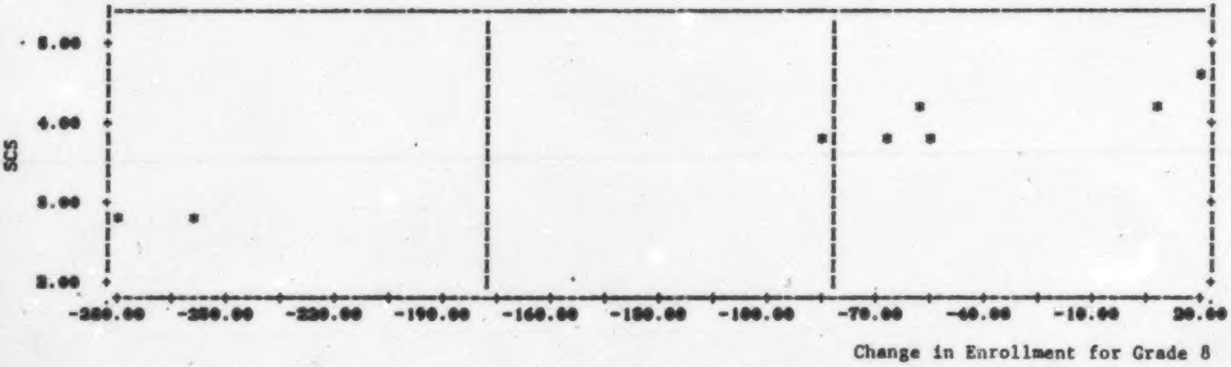


FIGURE A.2

SCATTERGRAM OF STATE CENTRALIZATION SCORES(SCS) ACROSS CHANGE IN ENROLLMENT FOR GRADE 8

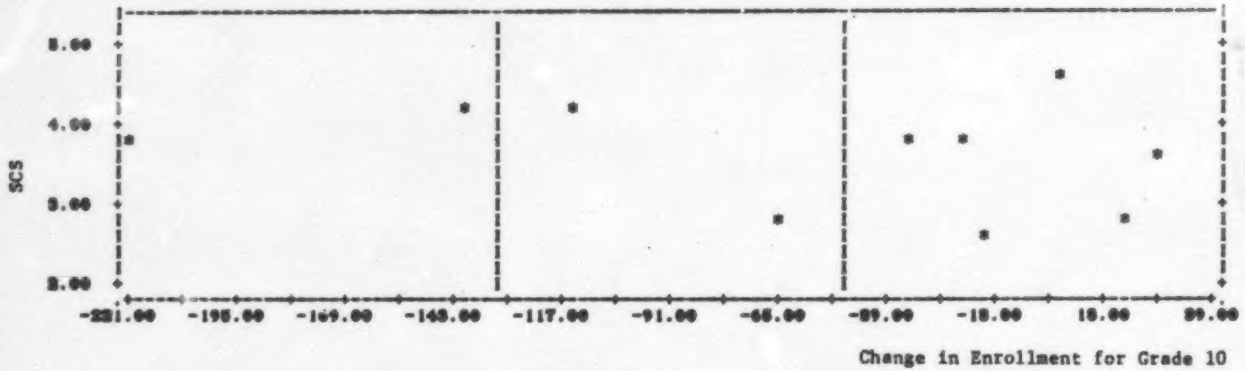


FIGURE A.3

SCATTERGRAM OF STATE CENTRALIZATION SCORES(SCS) ACROSS CHANGE IN ENROLLMENT FOR GRADE 10

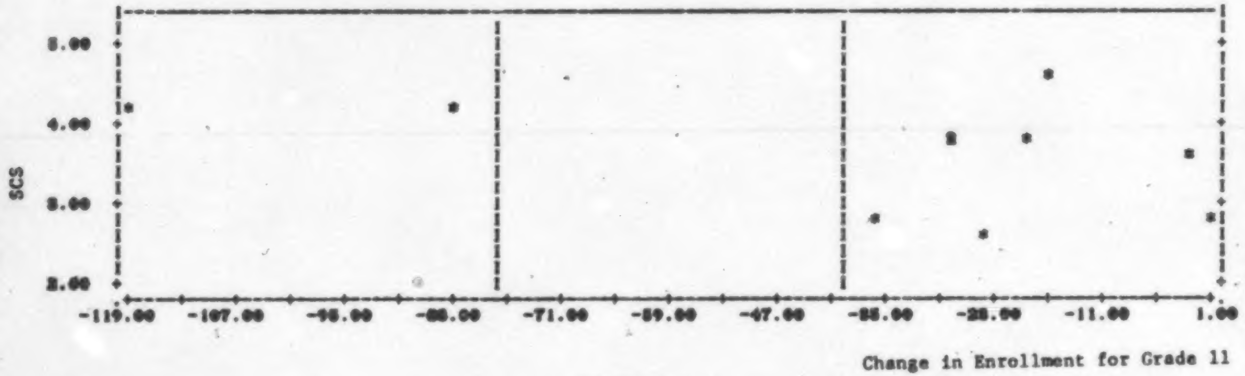


FIGURE A.4

SCATTERGRAM OF STATE CENTRALIZATION SCORES(SCS) ACROSS CHANGE IN ENROLLMENT FOR GRADE 11

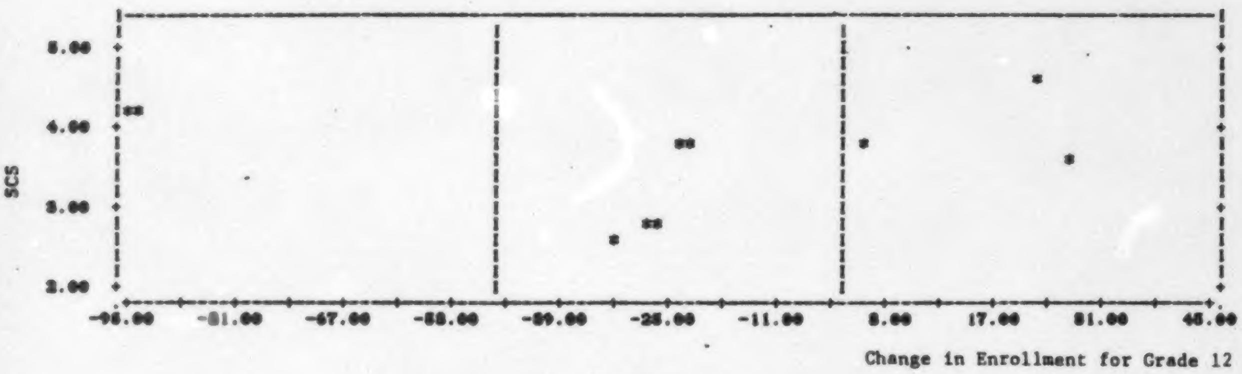


FIGURE A.5

SCATTERGRAM OF STATE CENTRALIZATION SCORES(SCS) ACROSS CHANGE IN ENROLLMENT FOR GRADE 12

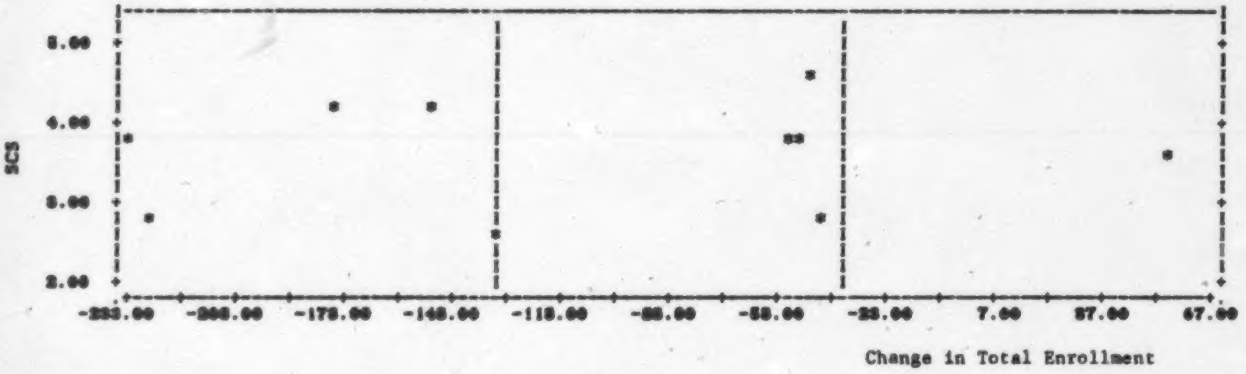


FIGURE A.6

SCATTERGRAM OF STATE CENTRALIZATION SCORES(SCS) ACROSS CHANGE IN TOTAL ENROLLMENT

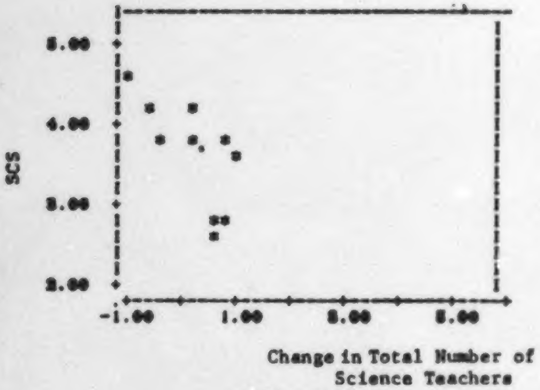


FIGURE A.7

SCATTERGRAM OF SCS ACROSS CHANGE IN TOTAL NUMBER OF SCIENCE TEACHERS

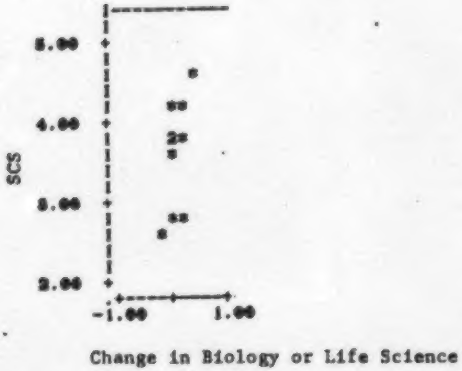


FIGURE A.8

SCATTERGRAM OF SCS ACROSS CHANGE IN OFFERING BIOLOGY OR LIFE SCIENCE

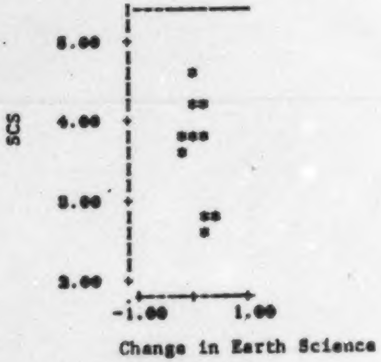


FIGURE A.9

SCATTERGRAM OF SCS ACROSS CHANGE IN OFFERING EARTH SCIENCE

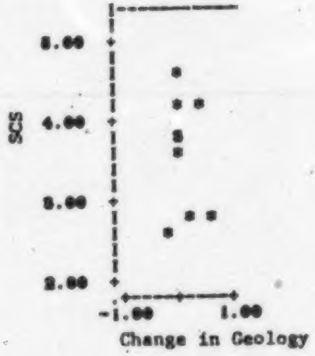


FIGURE A.10

SCATTERGRAM OF SCS ACROSS CHANGE IN OFFERING GEOLOGY

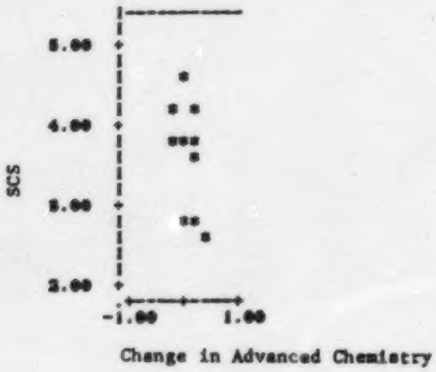


FIGURE A.11

SCATTERGRAM OF SCS ACROSS CHANGE IN OFFERING ADVANCED CHEMISTRY

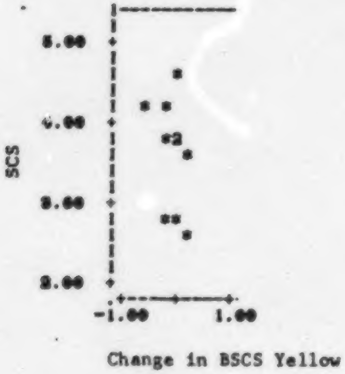


FIGURE A.12

SCATTERGRAM OF SCS ACROSS CHANGE IN USE OF BSCS YELLOW

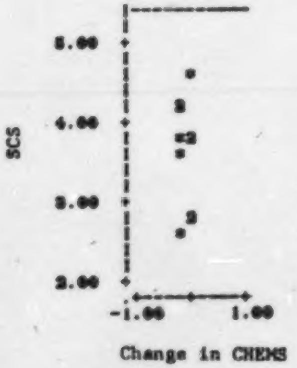


FIGURE A.13

SCATTERGRAM OF SCS ACROSS CHANGE IN USE OF CHEM STUDY

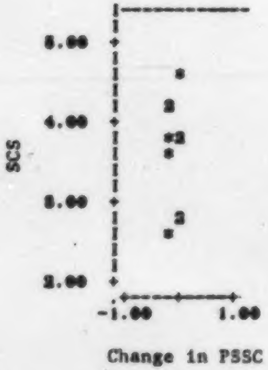


FIGURE A.14

SCATTERGRAM OF SCS ACROSS CHANGE IN USE OF PSSC

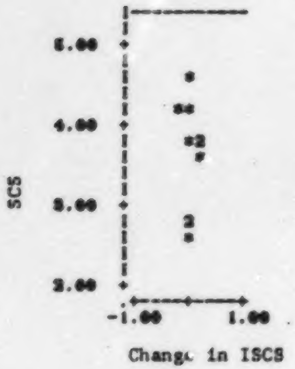


FIGURE A.15

SCATTERGRAM OF SCS ACROSS CHANGE IN USE OF ISCS

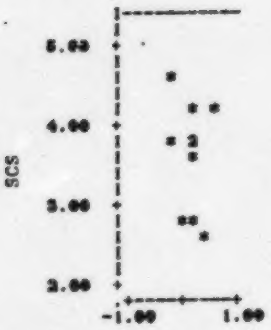


FIGURE A.16

SCATTERGRAM OF SCS ACROSS CHANGE IN TEACHING ENVIRONMENTAL EDUCATION (EE) IN SCHOOL

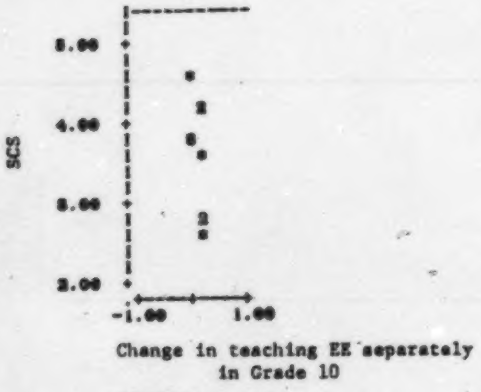


FIGURE A.17

SCATTERGRAM OF SCS ACROSS CHANGE IN TEACHING EE SEPARATELY IN GRADE 10

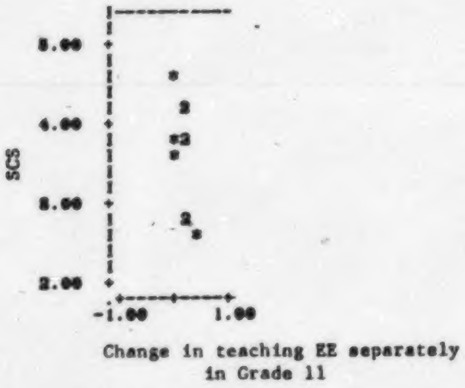


FIGURE A.18

SCATTERGRAM OF SCS ACROSS CHANGE IN TEACHING EE SEPARATELY IN GRADE 11